Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

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Note.—Initialled abstracts are written by the following:

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* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VII, No. 4.

Part 1. Empire Section

STATISTICS 519

1080. HENDRICKS, W. A. 519.24

A note on the method of "differential regression" in analysis of variance.

J. Agric. Sci. 1937 : **27** : 188–90.

The author refers here to a method given in a previous paper (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 839), wherein the correction of experimental data by means of covariance, using individual class regression coefficients, was carried out, and shews how the method should be modified to allow for the sampling errors of the individual regression coefficients. A previous example is shewn adjusted. J. W.

1081. COCHRAN, W. G. 519.241

The χ^2 distribution for the binomial and Poisson series, with small expectations.

Ann. Eugen., Camb. 1936 : **7** : 207–17.

In considering samples from the binomial and Poisson series with small expectations, the exact distribution of χ^2 is compared with the ordinary distribution as tabled, which seems to give a satisfactorily close agreement except in very extreme cases. Approximations for the mean and variance of χ^2 in samples in which the mean is fixed are worked out for any population, and from these results the exact normal approximation to the χ^2 distribution for the binomial series is obtained. The likelihood criterion is suggested as more appropriate than χ^2 to the general problem of testing discrepancies between observation and hypothesis. J. W.

1082. COCHRAN, W. G. 519.241

The efficiencies of the binomial series tests of significance of a mean and of a correlation coefficient.

J.R. Statist. Soc. 1937 : **100** : 69–73.

Exact tests of significance of a mean, or of a correlation coefficient, are sometimes for convenience replaced by a simple probability test based on the frequency of positive and negative deviations, and the binomial distribution. The author compares the efficiencies of these tests with those of the exact tests, and shews that in the case of a mean about $\frac{1}{3}$ of the information is discarded, while with a correlation coefficient the efficiency is rather low, and the approximate test should be used with caution. J. W.

1083. FISHER, R. A. 519.241

The fiducial argument in statistical inference.

Ann. Eugen., Camb. 1935 : **6** : 391–98.

A method of argument which, by taking into consideration the exact nature of the distribution of the ratio of a mean to its estimated standard error, provides fiducial limits to the values of the true mean, is extended to deal with posterior fiducial inferences. The method is applied to the difference between the means of two normally distributed populations, and to the variance of a normally distributed set of means. J. W.

1084. YATES, F. 519.25

Some examples of biased sampling.

Ann. Eugen., Camb. 1935 : **6** : 202–13.

Examples are given which shew that considerable bias may enter into the determination of the yield or other measurable characteristics of an agricultural crop if the area is sampled by a method which allows an element of personal selection to the sampler. The author concludes that, whatever the nature of the investigation, the only satisfactory method is to sample at random. J. W.

1085. 575(42)

LAWRENCE, W. J. C. 634.00.15(42)

Twenty-five years research at the John Innes Horticultural Institution.

Sci. Hort. 1937 : **5** : 87–97.

A review of the work of the John Innes Institution. Besides genetical and cytological research, such practical applications of research to horticulture as the fertility of fruits and fruit breeding are under investigation.

1086. STAPLEDON, R. G. 575:633(42.9)

The work of the Welsh Plant Breeding Station.

Trans. R. Welsh Agric. Soc. 1936 : 143–44.

A very brief account, mentioning some of the strains of grasses and the new oat Ceirch Llwyd Cwta produced by the Station.

GENETICS 575.1

1087. MATHER, K. 575.116.12:578.081

Types of linkage data and their value.

Ann. Eugen., Camb. 1936 : **7** : 251–64.

It is shewn that a genotypically completely classified F_2 yields twice as much information about the recombination fraction as a back-cross of equal size. Such a classification can only be performed by progeny tests.

When both factors operate without complete dominance it is possible to classify the F_2 completely except for the separation of the coupling and repulsion double heterozygotes. Such an F_2 yields twice the information of a back-cross in the case of close linkage either in coupling or repulsion and an amount equal to that of the back-cross in the case of independent genes. This type of F_2 is therefore as useful as a back-cross for the detection, and more useful for the estimation of linkage.

The more usual F_2, with complete dominance of one allelomorph of each of the two pairs segregating is about as efficient as a back-cross in the case of close coupling, rather less than half as efficient when the factor pairs are independent and very inefficient in the case of close repulsion.

The last case, that of close repulsion, is of interest as it arises when the linked factors have arisen in different strains and no double recessive exists, the experimenter being thus forced to use F_2 data from an F_1 double heterozygote in the repulsion phase. It is then more profitable to complete the classification of the F_2 by growing F_3 progenies to determine the genotype than to grow further F_2 families. The case is considered where such F_3 families are obtained by selfing the F_2 individuals.

F_3 families from singly dominant individuals (Ab and aB) are profitable when the recombination value p does not exceed 0·08 and 24 plants should be grown in each family. In this case the further information is gained solely from completing the F_2 classification.

From F_3 families grown from doubly dominant F_2 individuals (AB) further information is obtained not only from the completion of the original F_2 but also from the segregation of doubly heterozygous F_2 individuals. Such families are profitable to grow if p does not exceed 0·22. The minimum number of plants required for the level of accuracy chosen (999/1000) is 27 for p up to 0·15 and increases to 49 as the recombination value increases up to 0·22.

The process of calculating the recombination value is briefly illustrated.

1088. BUNAK, V. V. 575.12

Changes in the mean values of characters in mixed populations.

Ann. Eugen., Camb. 1936 : **7** : 195–206.

A mathematical analysis of the changes in the mean value of a character under different types of crossing, when there are different factors producing the same phenotypic effect, different types of interaction being considered.

EVOLUTION 576.12

1089. GATES, R. R. 576.12:575

The genetic survey as a method of evolutionary study.

Rep. Brit. Ass. Blackpool, September 9–16, p. 420. (Abst.)

Seeds of all forms of *Oenothera*, collected in Eastern Canada in 1932 and 1935 and then grown shewed a great range of variation which included new species and varieties. The method provided an opportunity for an intensive genetical survey of the phylogeny and geographical distribution of the genus.

AGRICULTURE 63

1090. CHADWICK, D. 63:061.6(42)

The Imperial Agricultural Bureaux.

Emp. Cott. Gr. Rev. 1937 : **14** : 93–100.

An account of the organization, functions and activities of the Bureaux.

FIELD TESTS 631.421

1091. SUMMERBY, R. 631.421:519.24

The use of the analysis of variance in soil and fertilizer experiments with particular reference to interactions.

Sci. Agric. 1937 : **17** : 302–11.

Examples are given of experiments planned and analysed according to Fisher's principles, emphasis being placed on the analysis and interpretation of the different interactions.

1092. YATES, F. 631.421:519.24

Incomplete randomized blocks.

Ann. Eugen., Camb. 1936 : **7** : 121–40.

A new method of arranging replicated experiments in randomized blocks when the number of treatments is greater than the number of experimental units in a block, is described. The arrangement is such that every two treatments occur together in a block the same number of times. The method of working out the experimental results by means of an analysis of variance is worked out and illustrated. A discussion of the relative efficiency of this arrangement and one in ordinary randomized blocks is given. J. W.

INTRODUCTION OF NEW SPECIES 631.524

1093. SAMPSON, H. C. 631.524(42)

The Royal Botanic Gardens, Kew, and Empire agriculture.

J. Roy. Soc. Arts 1935 : **83** : 404–19.

A survey of the work at Kew in relation to Empire agriculture. After describing briefly the early work on the introduction of *Cinchona* and rubber plants to the East the author outlines the part played by Kew in the work of breeding a banana suitable for transportation and resistant to Panama disease, in which material was grown under quarantine conditions at Kew before being sent to Trinidad. Similar quarantine work is developing in relation to cacao, the disease feared being witch's broom.

A study of the varieties of cowpea (*Vigna unguiculata*), similar to that carried out on sorghum (Cf. "Plant Breeding Abstracts", Vol. VII, p. 122), has been begun.

In the discussion which follows the paper tribute is paid to the work on plant introduction which has been done by the Royal Botanic Gardens.

PLANT DISEASES 632

1094. GUPTA, S. N. DAS 632.4:575.2

Saltation in fungi.

Lucknow Univ. Stud. Fac. Sci. Sess. 1934–35 (1936) No. V : Pp. 84.

A general survey, with an extensive bibliography.

1095. 632.451.2:576.16:575.242

HANNA, W. F. 633.11–2.451.2–1.521.6:575.42

Physiologic forms of loose smut of wheat.

Canad. J. Res. 1937 : **15** : Sect. C : 141–53.

Experiments were carried out to test the pathogenicity of collections of loose smut from certain wheat varieties in Manitoba and the extent to which the pathogenicity of a loose smut collection can be modified by propagating it for several generations on a particular variety of wheat.

It was found that mixtures of physiological forms could be purified by the host and four forms were found in all, one of which apparently arose as a mutation during the course of the work.

Selection for freedom from infection was performed in the susceptible variety Reward, which usually shewed a few uninfected plants under conditions of artificial inoculation. As this selection did not materially alter the percentage of smutted plants in five generations it is concluded that the smut-free plants had escaped infection because of faulty inoculation.

ECONOMIC PLANTS 633

1096. BOSE, R. D. 633:016(54)

List of publications on the botany of Indian crops, Part II for the period 1928-1932 (compiled in the botanical section, Pusa).

Misc. Bull. Imp. Coun. Agric. Res., Delhi 1936 : No. 12 : Pp. 198.

The first of these bibliographies covered the period 1917–27; this, the second, continues the work to 1932. The crops dealt with are the cereals, legumes, oil-seeds, fibres, cotton, indigo, sugar beet, sugar cane, potatoes, tobacco, *Capsicum*, *Papaver*, sweet potatoes, forage and green manuring plants. Though no claim is made to completeness the lists cover a wide range of interests and include the more important contributions to the subject.

1097. 633.00.15(67.8)

NOWELL, W. 633.526.2:575

The first ten years of the Amani Research Station.

Emp. Cott. Gr. Rev. 1937 : **14** : 101–09.

The activities of the Amani Research Station are briefly reviewed. The research programme is divided into six sections: soil science, plant physiology, plant genetics, plant pathology, entomology and plant biochemistry.

Agave has been a subject of investigation. Seedlings of *A. sisalana*, though shewing great diversity, have not yielded any form which promises to be superior, agriculturally or commercially, to the parent variety.

Seedlings of *A. amaniensis* and its hybrids with *A. sisalana*, however, offer a choice of planting material with fibres of different properties which should assist in the extension of its uses.

CEREALS 633.1

1098. CALLAGHAN, A. R. and 633.1:575(94.2)

BREAKWELL, E. J. 635.656:575(94.2)

Activities at Roseworthy Agricultural College, 1935-36. Part IV.—Cereal breeding and experimental work.

J. Dep. Agric. S. Aust. 1936 : **40** : 111–23.

The methods and results of cereal breeding work at the Roseworthy Agricultural College are described (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 845 and Vol. V, Abst. 210).

Breeding for quality is regarded as of prime importance and the more recent crosses have been made with this in view. The results of some of the crosses are described. The varieties Baringa and Dundee have proved valuable parents.

Intensive selection work is being done with the varieties Sword and Ford. Strains resistant to shattering have been selected from both varieties. Pelshenke's method for testing baking quality is exclusively used.
Oat breeding is in progress.
Crosses have been made to combine the malting quality of the two-rowed barleys with the high yield of the six-rowed types.
Breeding in field peas includes the production of an early and high yielding type. Selections of White Brunswick are being made.
The results of variety trials with the different cereals are given.

1099. 633.1:575(94.6)
Field day at the Strathroy experimental area.
Tasm. J. Agric. 1937 : **8** : (N.S.) 27–32.
The cultivation of the wheat variety Braemar Velvet has declined considerably on account of the development of inferior strains and other impurities. Single plant selection is being carried out to rebuild this variety.
Similar experiments are being made with Algerian oats. Prostrate winter growth was found to be "linked" with late maturity and erect winter growth with earliness.
Breeding work is in progress to improve the yield and disease resistance of Braemar Velvet and to produce wheats of better baking quality.

WHEAT 633.11

1100. NEETHLING, J. H. 633.11:575.127.5:633.14
Some genetic aspects of a wheat-rye hybrid.
S. Afr. J. Sci. 1935 : **32** : 172–78.
An account of the more practical aspect of wheat-rye crosses, of the difficulties encountered in obtaining them and of a successful pollination of a Chinese wheat (obtained from Professor Biffen, Cambridge), by Cape Early rye in 1924. Up to the time of writing the reciprocal had not been obtained.
Except in very rare instances, the F_1 wheat-rye hybrids were self-sterile but capable of fertilization by wheat pollen. F_1 hybrids of Chinese with other wheats, and varieties extracted from crosses in which Chinese wheat was one of the parents were capable of fertilization with rye pollen.
Though no cytological examination had been made, it is suggested that the presence of certain rye characters in the plants obtained from the seeds of F_1 plants, and which in the main resemble wheat, may be due to a transference of rye chromosomes.
Some early relevant literature is cited.

1101. KOSTOFF, D. and 633.11:575.127.5:633.289:575.129
ARUTIUNOVA, N. 633.11:575.127.5:633.289:633.14
Studies on polyploid plants. *Triticum-Haynaldia* hybrids with special reference to the amphidiploids *Triticum dicoccum* x *Haynaldia villosa*.
Curr. Sci. 1937 : **5** : 414–15.
From open-pollinated flowers of the F_1 hybrid *Triticum dicoccum* x *Haynaldia villosa* two plants were obtained, one with 28 somatic chromosomes and the other with 42. The latter probably arose by pollination by *T. vulgare*, the female gamete having been unreduced. The plant thus combines the genoms of three species, *T. dicoccum* (n = 14), *H. villosa* (n = 7) and *T. vulgare* (n = 21).
By pollinating the F_1 of *T. dicoccum* x *H. villosa* with rye pollen a trigeneric hybrid with all the chromosomes of *T. dicoccum*, *H. villosa* and *Secale cereale* (14 + 7 + 7 = 28) was obtained.
Seven plants were obtained from the cross (*T. dicoccum* x *H. villosa*) x *T. Timopheevi* (n = 14). One of these plants was an amphidiploid *T. dicoccum* x *H. villosa*, apparently arising apomictically and the other six were triple hybrids; five of the six had 35 somatic chromosomes, 21 from *T. dicoccum* x *H. villosa* and 14 from *T. Timopheevi* but the other had only 32, having

probably been derived from an egg cell with only 18 chromosomes. Another plant obtained from this combination had 49 somatic chromosomes, apparently being derived from an egg cell with 26 chromosomes.

Two amphidiploids were obtained from open-pollinated flowers of *T. dicoccum* x *H. villosa*. These produced 98 per cent viable pollen and usually produced 21_{II} or $20_{II} + 2_{I}$ at the reduction division. Meiosis was usually regular except for deviations introduced by the univalents and the tetrads produced only rarely shewed irregularities. The amphidiploids were fully fertile.

From the cross (*T. vulgare* x *H. villosa*) x *T. vulgare* two plants were obtained with 48 or 49 chromosomes, i.e. 21 + 7 + 21. At meiosis $21_{II} + 7_{I}$ were observed.

1102. Fraser, J. G. C. and
Gfeller, F. 633.11:578.088.1:575.11
The inheritance and use of phenol colour reaction in hard red spring wheats.
Sci. Agric. 1936 : **17** : 243–49.

Tests of the phenol reaction of the spike and kernel of the spring wheat varieties Canus, Garnet, Marquis, Red Fife, Reward and Ruby made at two day intervals from the soft dough stage to maturity shewed that the material to be tested must be matured and have a dry matter content of at least 80 per cent.

The crosses between Garnet and Red Fife indicated that kernel and spike phenol colour are each due to a single gene but if the phenol colour reactions of both are taken together a 1:2:1 ratio is obtained. Either allelomorphic factors or complete linkage of the two is suggested in explanation and the latter is thought to be the most likely from the standpoint of development.

1103. Varada Rajan, B. S. 633.11–2.452–1.521.6:575(54.7)
The problem of rust of wheat in India.
Poona Agric. Coll. Mag. 1936 : **28** : 107–17.

A very brief review of the problem of resistance to yellow, brown and black rust. In India work is needed in the production of resistant varieties of wheat suitable for the various wheat-growing districts and a plea is made for decentralization.

1104. 633.11–2.452–1.521.6:575(94.4)
Macindoe, S. L. 633.11(67.62)
The new era in breeding wheats resistant to stem rust.
J. Aust. Inst. Agric. Sci. 1937 : **3** : 25–31.

The importance of the mature plant resistance which has been derived from emmer and *durum* wheats is indicated. The use of field rather than greenhouse tests is urged and, since resistance may vary with the age of the plant, it should be tested at the plant's most critical period, the after-heading stage.

The great value of rust-resistant lines from Kenya is stressed. Though little is known of the type of resistance they possess, one line, Kenya C. 6040, has so far been completely immune in Australia; their rust resistance does not appear to be associated with undesirable characters like drought susceptibility or straw weakness. Promising lines have been obtained from a cross Kenya x Florence x Dundee. Further crosses of these hybrid lines with Pusa 4 give promise of combining very high baking quality with their stem rust resistance, straw strength and good yield.

1105. Foster, W. R. and Jeffery, C. E. 633.11–2.7–1.521.6:581.143
Resistance of winter wheats to Hessian fly.
Canad. J. Res. 1937 : **15** : Sect. C : 135–40.

Data are presented on the resistance of a number of winter wheat varieties and hybrids to Hessian fly at Saanichton, British Columbia. There was a high positive correlation between number of days to maturity and percentage of culms infested ($r = +0{\cdot}845 \pm 0{\cdot}05$) and a negative correlation between height of plants on April 1st (emergence of Hessian fly) and percentage of culm infestation. These correlations are taken to shew that stage of growth at the time of the spring emergence of the Hessian fly may account for the differential resistance of varieties of winter wheat at Saanichton.

1106. Wenholz, H. and Stening, H. C. 633.11:664.641.016:575(94.4)
633.11 Gular
Gular wheat. An early-maturing, productive, new variety of high baking quality.
Agric. Gaz. N.S.W. 1937 : **48** : 131–33, 144.

The parts of New South Wales for which the new wheat is likely to be suitable are given and then its history and characteristics are described.
Gular arose from a cross between a selection from Marshall's No. 3 and an unnamed Farrer wheat known as Wagga No. 13. It is an early maturing wheat, little inferior to Pusa 4 in quality and yielding well on account of its ability to fill three or four grains per spikelet and to tiller well for such an early wheat. It is susceptible to flag smut and stem rust.

OATS 633.13

1107. Robb, W. 633.13:581.48:575
Huskless oats.
Scot. J. Agric. 1937 : **20** : 161–65.

The Canadian huskless oat varieties Liberty and Laurel have been grown at Corstorphine but as compared with Victory the yield of grain (without husks) has been too low to warrant their cultivation economically.
They have been crossed with ordinary husked oats, including Argentine, Beseler's Prolific, Elder and Bond in the hope of evolving a huskless oat better suited to Scottish conditions. Several huskless selections from the cross Liberty x Argentine, which are now in the sixth generation, appear to be fixed and are being multiplied for the first time this year. The selections have good-sized kernels and compare favourably with the huskless parent.

1108. Welsh, J. N. 633.13–2.452–1.521.6:575
The synthetic production of oat varieties resistant to race 6 and certain other physiologic races of oat stem rust.
Canad. J. Res. 1937 : **15** : Sect. C : 58–69.

The Hajira strain of oats, resistant to races 1, 2, 3, 5 and 7 and semi-resistant to race 9 of *Puccinia graminis Avenae* Erikss. and Henn., was crossed with the Joanette Strain which is resistant to races 1, 3, 4 and 10 and gives an indeterminate reaction to race 5. Both are susceptible to strain 6.
Those of the progeny resistant to 1, 2, 3, 4, 5, 6 and 7 were grown on to the F_6 when 93 pure lines were obtained. The reaction of these lines to race 6 at different temperatures and at different stages of development was determined. It was found that in the greenhouse temperature affects the reaction of the lines in the later stages of growth as well as in the seedling stage.
A regional type of resistance to race 6 occurred at the more advanced stages of growth. A comparison of the results obtained in the field with the results in the greenhouse, shewed that the field reaction corresponded with the reaction at 60° in the greenhouse.
Line 811 at 60° F is very resistant to races 1, 2, 3, 4, 5, 7, 8, 9 and 10 and resistant to 6.

MAIZE 633.15

1109. "Student." 633.15:575.42:575.113.4
A calculation of the minimum number of genes in Winter's selection experiment.
Ann. Eugen., Camb. 1934 : **6** : 77–82.

An analysis of the results with respect to oil content in F. L. Winter's experiment, in which mass selection for high and low oil content and high and low protein content has been carried on since 1896. Starting with 163 ears with a mean oil content of 4·68 per cent and a range from 3·9 to 6·0 a high oil content line has been obtained with a mean in 1924 of 9·86 and a range from 8·4 to 11·7 and a low oil content line with a mean of 1·51 and a range from 0·9 to 2·2. The two lines are thus quite outside the range of the original variety.

Making certain assumptions the author calculates that the oil percentage was conditioned by a number of genes at least of the order 20–40, though it may be much greater, possibly 200–400. The number is not at all likely to be of the order 5–10.

1110. Brieger, F. G. 633.15:581.331.2:575.116.1
Genetic control of gametophyte development in maize. I. A gametophyte character in chromosome five.
J. Genet. 1937 : **34** : 57–80.

Details are given of two methods of determining the locus of a factor affecting pollen tube growth when the segregation of two factors linked with it is known. One method applies to the case when one of the recessive classes cannot be distinguished from the double recessive and the other to the case when such a distinction is possible. The second method appears to be more accurate.

In the present case the linked factors whose segregation was affected were those for the endosperm characters brittle–1 (*bt 1*) and purple–1 (*pr 1*).

The families giving aberrant segregations were classified into groups according to the degree of deviation; χ^2 tests shewed that the groups so established were homogeneous. The recombination value for *bt* and *pr* was estimated by combining families in which the gametophyte gene was working in opposite directions. Knowing this value the amount of elimination caused by the gametophyte factor (*ga 2*) was calculated. In the group with weak elimination about 42 per cent of the functioning gametes carried the recessive *ga* allelomorph, in the group with medium elimination about 14 per cent and in the group with strong elimination about 7 per cent; 50 per cent would be expected in the absence of competition. The degree of elimination is dependent on the genetic constitution of the female as well as of the male parents. Next the recombination values *bt–ga* and *ga–pr* were calculated. These shewed great variability but were reasonably consistent in view of the complicated method of calculation. The order of the genes is given as *bt 1*–9·79–*ga 2*–5·21–*pr 1*. The two recombination values have an error of $\pm$1·95 units. (Cf. also "Plant Breeding Abstracts", Vol. VII, Abst. 983.)

BARLEY 633.16

1111. Harrison, T. J. 633.16:575:061(71)
The organization of barley investigations. The National Barley Committee.
Barley in Canada, Canad. Soc. Tech. Agric. 1936 : 92–99.

The Canadian National Barley Committee has six sub-committees, one of which deals with plant breeding and production. The aim in breeding is to develop better malting and feeding barleys for the different areas in Canada and to combine with the market qualities good agronomic properties such as yield, disease-resistance, strength of straw, smooth awns, and absence of "necking." Several promising new types have been produced and are still being tested. The members of the committee co-operate in carrying out variety tests.

1112. Rangaswami Ayyangar, G. N.,
Sankara Ayyar, M. A. and
Kunhikoran Nambiar, A. 633.174:575.11–181.13:575.11"793"
The inheritance of height *cum* duration in sorghum.
Madras Agric. J. 1937 : **25** : 107–18.

In a selection from the Kurnool variety Patcha Jonna (*Sorghum Durra* var. *mediocris* Snowden) it was observed that 35 plants out of 130 were tall and late in maturing. On further investigation it was found that this was due to a single recessive character, the normal condition in this variety, "short-early," being dominant.

In the recessive character "tall-late" the tallness was due to a greater number of internodes and the relation between the length of an internode and its number from the base was different from that in the "short-early" type. The recessive factor is designated in_1.

1113. Rangaswami Ayyangar, G. N. and 633.174:581.162.3
Panduranga Rao, V. 633.174:581.33
Studies in sorghum—the great millet III. Anther, pollen and stigma.
Indian J. Agric. Sci. 1936 : **6** : 1299–1322.

Varietal differences were noted in anther and pollen grain size. Hyaline, non-viable pollen grains (termed "dummy pollen" by the authors) were observed and studied. Sorghum pollen was successfully germinated in artificial media, and considerable variation was found in the germination capacity of pollen from various cultivated varieties. Pollen from staminate flowers was distinctly poorer in germinating and fertilizing capacity than pollen from hermaphrodite flowers. Darkness was found to inhibit germination of pollen. Pollen longevity was studied and pollen was found to be capable of effecting fertilization up to the third day though in weak measure.

The receptivity of the stigma was also studied. B. P. P.

1114. Rangaswami Ayyangar, G. N.,
Panduranga Rao, V.,
Kunhikoran Nambiar, A. and
Ponnaiah, B. W. X. 633.174:581.45:575.11.061.5
The occurrence and inheritance of waxy bloom on sorghum.
Proc. Indian Acad. Sci. 1937 : **5** : Sect. B : 4–15.

Sorghum plants with a heavy bloom on the leaf-sheath, leaf-blade, internode, panicle branch and glume were crossed with plants in which the waxy covering was sparsely distributed. Heavy bloom *H* behaved as a simple dominant to sparse bloom *h* and was independent of *P* and *Q*, the factors for leaf-sheath colour, of *Mu* for undulated leaf blade, of *Z* for pearly grain surface and of the factors B_1 and B_2 for brown grain.

1115. Rangaswami Ayyangar, G. N.,
Sankara Ayyar, M. A. and
Panduranga Rao, V. 633.174:581.45:575.116.1.016.6:581.6
Linkage between purple leaf-sheath colour and juiciness of stalk in sorghum.
Proc. Indian Acad. Sci. 1937 : **5** : Sect. B : 1–3.

Crosses were made between varieties of sorghum with brown leaf-sheath and a white midrib, which implies a pithy stem and those with a purple leaf-sheath and dull midrib, implying a juicy stalk.

The F_1 plants had purple leaf-sheaths and white midribs. In F_2 the distribution of the four groups, purple leaf-sheath with white or dull midrib and brown leaf-sheath with white or dull midrib, could only be explained on the assumption of a linkage between *P* for purple leaf-sheath and *D* for juiciness of stalk. The recombination percentage gave the value $30 \pm 1{\cdot}8$ in the repulsion phase.

RICE 633.18

1116. Sethi, R. L.,
Sethi, B. L. and
Mehta, T. R. 633.18:575.11"793"
Inheritance of earliness in United Provinces rices, I.
Indian J. Agric. Sci. 1936 : **6** : 1246–73.

In a number of crosses between early and late types of rice, the F_1 was found to shew incomplete dominance of lateness. The F_2 could be divided into an early and a late group in the ratio of 1 : 3. The means of these groups differed from those of the parents. The results are explained on the assumption that three factors are here interacting; it is pointed out that beside these main factors minor factors may also be concerned.

Yield per ear was generally greater in the late hybrids than in the early ones. No correlation was found between flowering duration and yield or between flowering duration and tillering.

B. P. P.

1117. Ramanujam, S. 633.18:576.312.35:576.356.5
Chromosome studies in the *Oryzeae*.
Rep. Brit. Ass. Blackpool, September 9–16, 1936 : 418–19. (Abst.)

The basic number of chromosomes is held to be 5. The section *Oryzineae* have developed a secondary basic number 12 by means of secondary polyploidy. It is suggested that certain species of *Oryza* have been derived through allopolyploidy.

ROOTS AND TUBERS 633.4

1118. Richharia, R. H. 633.42:575.127.2:576.354.4
Cytological investigation of 10-chromosome species of *Brassica* and their F_1 hybrids.
J. Genet. 1937 : **34** : 45–55.

The species concerned were *B. chinensis*, *B. pekinensis* and *B. Rapa*. In their somatic chromosomes six types could be distinguished, in each case, by their morphology and size. At meiosis the corresponding chromosomes could be distinguished to a certain extent by their size. Bivalent formation was regular except in one cell in *B. pekinensis* where two univalents were found. Secondary association was studied and the results are given in tabular form with drawings. The degree of association is greater than was expected from the classification of the somatic chromosomes and it was noticed that association often occurred between bivalents of different sizes.

Meiosis, as far as it was studied, was regular in the hybrids *B. chinensis* x *B. pekinensis* and *B. Rapa* x *B. chinensis*, but in the hybrid *B. pekinensis* x *B. Rapa* occasional univalent formation was observed and counts at second metaphase shewed that the distribution at first anaphase was not always regular.

No conclusions are drawn as to the basic number in this group of species, as it is considered that the secondary association has been affected by structural changes.

1119. 633.42:575.127.5:635.15:575.129
Richharia, R. H. 635.3:575.127.5:635.15:576.354.4
Cytological investigation of *Raphanus sativus*, *Brassica oleracea*, and their F_1 and F_2 hybrids.
J. Genet. 1937 : **34** : 19–44.

The eighteen somatic chromosomes of *B. oleracea* (Brussels sprout, curly kale and cabbage) could be classified into seven types, the haploid set being *A*, *BB*, *b*, *C*, *DD*, *E* and *F*. Meiosis was quite regular, though in two cells in kale preparations and in every cell of cabbage preparations from two plants a ring or chain of four was observed. Lagging was occasionally seen at anaphase. Secondary association was studied at the first metaphase and it was found that there was more association than was to be expected from the classification of the somatic chromosomes, indicating that morphologically dissimilar chromosomes contain homologous

segments probably as a result of structural change. Type *b* is to be considered homologous with *B*.

The eighteen somatic chromosomes of *R. sativus* were classified into six types, the haploid set being *A*, *BB*, *C*, *DD*, *E* and *FF*. Irregularities at meiosis included lagging bivalents at anaphase and occasional univalents. Here again there was a higher degree of secondary association than was to be expected from the morphology of the somatic chromosomes.

The first point of interest in the F_1 of the cross *R. sativus* x *B. oleracea* was the occurrence of primary pairing, from 0 to 6 bivalents being observed at prophase. In this respect the material differed from Karpechenko's, which shewed no bivalents in F_1. The chiasma frequencies of the F_1 and its parents at diakinesis are compared. Secondary associations involving univalents were observed, forming in some cases pseudo-gemini. At first anaphase the bivalents separate for the most part regularly, while the univalents are left on the equator or travel to the poles or remain scattered in the cytoplasm or, exceptionally, divide. Restitution nuclei occur as a result of the univalents forming a bridge between the poles. Following such a restitution nucleus the univalents may divide at the second division, giving gametes with 13–18 chromosomes. In addition to the dyads so produced other methods of division give rise to monads, triads and tetrads.

The F_2 plants shewed great diversity in fertility and were on the whole much less fertile than Karpechenko's, four seeds per pod being the most obtained in the present material as against ten per pod recorded by Karpechenko. Their somatic chromosome numbers varied between 28 and 36, one, however, approaching 48. Another difference from Karpechenko's material is the occurrence of hypotetraploid forms with 30, 32 and 34 chromosomes. At meiosis in addition to bivalents, univalents occurred quite commonly, trivalents more seldom and though quadrivalents did occur they were very rare. The degree of secondary association observed was more than the sum of the associations observed in the parents and agreed well with that expected if chromosomes given similar letters in the parents were actually homologous.

In the discussion it is pointed out that the difference in meiosis in F_1 between the present material and Karpechenko's may be due to genetical or environmental factors. The significance of chiasma pairing in F_1 with respect to fertility and the occurrence of hypotetraploid forms in F_2 is briefly discussed.

1120. 633.491:576.16
633.491:575:575.2

McIntosh, T. P.

Recent developments in connection with the potato.

Gdnr's Chron. 1936 : **99** : Ser. 3 : 374–75, 391, 408-09.

A report of a lecture delivered to the Royal Caledonian Horticultural Society in which the speaker dealt with the country of origin of the potato, varietal differences and methods of identification, the trend of potato breeding in England and Scotland and the problem of evolving disease resistant forms. Variation and mutation were also discussed with special reference to the work of Asseyeva (Cf. "Plant Breeding Abstracts", Vol. III, Abst. 88 and Vol. V, Abst. 1041).

FIBRES 633.5

1121. 633.51:575(54)

Annual Report of the Indian Central Cotton Committee, Bombay, for the year ending 31st August, 1936.

Bombay 1937 : Pp. 234.

Inter alia the progress in the different schemes (Cf. "Plant Breeding Abstracts", Suppl. II, pages 24–27) is reported.

In the Madras *Herbaceum* Scheme, 4714 has again proved satisfactory in a year of drought. It has, however, the disadvantage of being a narrow-lobed variety liable to be mistaken for *G. roseum* and attempts are being made to isolate broad-lobed mutants which occur in this

strain. Promising results have been obtained in the Nadam Cotton Breeding Scheme from hybrids between Co.2 (Cambodia) and U.4 and Co.2 and A.12 (South African).
Wilt-resistant strains selected from crosses in connexion with the Broach Cotton Breeding Scheme, Bombay Presidency, are to be tested for purity of characters. Three wilt-resistant selections in the Jalgaon Cotton Breeding Scheme have maintained the superiority noted in the preceding year.
The strain 43F chosen for distribution in the Punjab Botanical Scheme maintained its superiority over the older types, while another new strain of American cotton, 47F, appears to be its superior in respect of yield, ginning out-turn and hardiness and is capable of spinning up to 50's standard warp counts. In the Punjab Root Rot Scheme no resistant type has been found either in desi or American cottons, though selection is being continued.
In addition to the three strains distributed in the Central Provinces Botanical Scheme, V–434, Late Verum and V–438, the two American types Buri A.K. special and No. 107 have done well. Six promising strains isolated from the *indicum* types Bani 306 and E.B. 31 are being tested for wilt-resistance.
In the United Provinces the Cotton Survey Scheme has been continued in Rohilkhand and preliminary selections have been made. Single plant cultures selected from material obtained in 1934 from Bundelkhand were tested and promising plants selfed for further tests.
The Comilla Cotton scheme, started in Bengal in December 1934, is to study and improve *Cernuum* cotton and the work has consisted mainly in making and testing single plant selections and a certain amount of crossing.
Work in the Hyderabad Botanical Research Scheme consisted mainly in testing old and new strains and making single plant selections from Gaorani mixture and short staple varieties.
Five selections in the Baroda Root Rot Scheme have been found more resistant to the disease than the control.
In Mysore, the Doddahathi (American) Cotton Scheme was sanctioned in February 1935 for the purpose of breeding suitable types from the local Doddahathi or American cotton resistant to "red leaf" disease. Varieties have been tested for resistance and many crosses have been made between exotic, indigenous and wild varieties; the behaviour of their progenies to "red leaf" is to be studied next year.

1122. Evelyn, S. H. 633.51:575(72.98)
A short note on the progress of the Red Sea Island strains and Montserrat–V. 135 hybrids.
Rep. 4th Annu. Gen. Mtg W. Indian Sea Island Cott. Ass. St. Kitts, November, 1936. 1937 : 25–27.

Data are given in tabular form on the Red Sea Island strains produced by transferring the character red body—weak corolla spot from Trinidad Red Kidney to V. 135 and on the Montserrat–V. 135 hybrid strains (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 863). The Red Sea Island strains have reached the stage where they should be tested against V. 135 and this is being done.

1123. Skovsted, A. 633.51:575.127.2:576.354.4
Cytological studies in cotton. IV. Chromosome conjugation in interspecific hybrids.
J. Genet. 1937 : **34** : 97–134.

Brief data on the success in crosses not previously reported by the author and on the morphology of the resulting hybrids are given.
Chromosome conjugation was observed in some pure species to study its regularity. The following irregularities were noted: in *Gossypium aridum* (2n = 26) one cell out of 110 had $12_{II} + 2_{I}$, one had $12_{II} + 1_{I}$ and two had 12_{II}, elimination of chromosomes having apparently occurred in the last three cells; in one cell of *G. armourianum* (2n = 26) $7_{II} + 12_{I}$ was observed;

one cell out of 23 in *G. barbadense* (2n = 52) had $1_{IV} + 24_{II}$ and a possible quadrivalent was also observed in *G. taitense*. Secondary association was observed in some cells of *G. armourianum* and *G. aridum* indicating that the haploid number 13 is derived from a base number 6, with one chromosome repeated three times.

Chromosome conjugation in hybrids between 26-chromosome American species was very regular, 13 bivalents being found in each of 20 cells from *G. trilobum* x *G. aridum*, *G. armourianum* x *G. trilobum* and *G. armourianum* x *G. aridum*, except in one cell of the first hybrid, where $12_{II} + 2_{I}$ were seen.

The results in hybrids between African, Asiatic and Australian species with 26 chromosomes are reported next. The species used are grouped as follows: Asiatic cottons (*G. arboreum* and *G. herbaceum*), *G. anomalum*, a wild species from Africa, *G. Stocksii*, a wild species from India-Arabia and *G. Sturtii*, a wild species from Australia. In hybrids of Asiatic cottons with *G. anomalum*, from 7 to 13 bivalents (average 10·45–11·85 in different hybrids) occurred, with univalents and occasional trivalents and quadrivalents. In hybrids of Asiatic cottons with *G. Stocksii* from 0 to 11 bivalents occurred (average 3·20–7·05) and no multivalents while in Asiatic cottons x *G. Sturtii* 6 to 13 bivalents were found (average 9·5–10·2), with trivalents and quadrivalents as well as univalents in various cells.

The next class of hybrids studied comprises those between American species (2n = 26) and African, Asiatic and Australian species. In *G. anomalum* x *G. aridum* 0–7 bivalents (average 2·35) were observed, as well as occasional trivalents, in *G. anomalum* x *G. Davidsonii*, 0–6 bivalents (average 3·05) and no multivalents, and in *G. anomalum* x *G. trilobum* 2–11 bivalents (average 5·7) and an occasional trivalent. From 2 to 13 bivalents (average 6·35–9·56) with some trivalents and quadrivalents were found in hybrids of Asiatic cottons with *G. trilobum*; in such hybrids the author distinguishes the chromosomes from different parents by their size and states that allosyndetic bivalents are formed about twice as often as autosyndetic. In *G. Sturtii* x *G. armourianum* 5 to 13 bivalents (average 8·2) were observed, with odd trivalents and quadrivalents.

Turning now to hybrids between species with different chromosome numbers, the author describes the conjugation in hybrids between New World cottons (2n = 52) and American species (2n = 26). The New World cottons used were *G. barbadense*, *G. purpurascens*, *G. hirsutum*, *G. taitense* and *G. Darwinii*. In New World cottons x *G. aridum*, 5 to 17 bivalents (average 12·0–12·24), with 0–3 trivalents and an occasional quadrivalent were observed; a closely similar result was obtained with *G. armourianum* hybrids, except that no quadrivalent and only 0–2 trivalents were found. The results in New World cottons x *G. trilobum* were also very similar.

In hybrids between New World cottons (2n = 52) and African, Asiatic and Australian species (2n = 26) the 26-chromosome species used were *G. anomalum*, *G. Sturtii* and *G. Stocksii*. In *G. barbadense* x *G. anomalum* 0–8 bivalents (average 2·6) were observed and in *G. barbadense* x *G. Stocksii* 0–2 bivalents (average 0·55), the lowest yet observed by the author in a 39 chromosome hybrid. Five hybrids of the type New World cottons x *G. Sturtii* were studied; bivalents per cell ranged from 0 to 13 (average 3·1–7·6 in different hybrids); trivalents and multivalents were observed in these hybrids but not in the other two belonging to this group. Normal conjugation giving 26 bivalents was the rule in hybrids between New World cottons, only one cell with two univalents being found in a total of eleven cells, five from *G. barbadense* x *G. tomentosum* and six from *G. hirsutum* x *G. barbadense*.

In general the chiasma frequency per bivalent was positively correlated with the intensity of chromosome conjugation.

In the discussion the results, considered in connexion with results previously obtained, are shewn to confirm the cytological classification into three groups: (1) species from America and the neighbouring Pacific islands with 2n = 26, (2) species native to Africa, Asia and Australia with 2n = 26 and (3) species with 2n = 52 found in America and the islands of the Pacific Ocean. They also confirm the theory of origin of New World cottons by hybridization between an American 26-chromosome species and an Asiatic species.

It is emphasized that the difference in chromosome size between the two groups with 2n = 26 is not determined by a genetic factor.

1124. HARLAND, S. C. 633.51:575.243:575.127.2
The genetics of cotton. XVII. Increased mutability of a gene in *G. purpurascens* as a consequence of hybridization with *G. hirsutum*.
J. Genet. 1937 : **34** : 153–68.

The paper deals with the behaviour of the allelomorphs S^H (*hirsutum* petal spot) on a *hirsutum* genetic background, S^H on a background predominantly *barbadense* and S^P (*purpurascens* petal spot) on a *hirsutum* background.
In a back-cross of *hirsutum* spotted x spotless to recessive spotless there was a slight, insignificant excess of *s* plants. It was noted moreover that S^H is slightly mutable somatically in the heterozygous condition. This is shewn by the appearance of a streak of unpigmented tissue across the petal spot, the presence of one or more spotless petals in a flower, the production of flowers wholly spotless or the production of whole branches with spotless flowers.
The first back-cross of *hirsutum* spotted (S^H) x *barbadense* faintly spotted (*s*) to *barbadense* faintly spotted gave segregation not into spotted and spotless but into spotted and less spotted, owing to the occurrence of plus modifiers in *barbadense*. Two cases of somatic mutability were noted and there was again a slight excess of recessives.
In transferring the petal spot of *G. purpurascens* (S^P) to the genetical background of *G. hirsutum* by crossing and back-crossing repeatedly a considerable increase in somatic mutability as compared with S^H on the *hirsutum* background was observed in the second and third back-crosses. There was also, in many families, a marked deficiency of S^P plants; in several families they were missing altogether. Similar results were obtained whether the S^P factor came from *G. purpurascens* T 26 (from Colombia), T 159 (from Ecuador) or T 13 (from Antilles). Although little is known of the behaviour of S^P in *G. purpurascens* itself, it is considered that these results indicate that the mutability of the gene is increased by transference to the *hirsutum* background, presumably by depriving it of a stabilizing complex of genes present in *G. purpurascens* and operating to suppress mutability. It is mentioned that evidence from other crosses shews that the stability of S^P is little affected in the first back-cross to *hirsutum*. S^P from T 13 produces a mean spot grade of 6·6 and S^P from T 159 a mean spot grade of 5·4 in the third back-cross to *hirsutum*, as compared with 15·3 for S^H.

1125. NEELAKANTAN, L. and KONDAREDDY, G. 633.51:581.143.32:581.481
Seedling abnormalities in cotton.
Madras Agric. J. 1937 : **25** : p. 50.

Four different types of abnormalities affecting the structure, attachment and number of the cotyledons of cotton seedlings are briefly described.

1126. 633.524.3:576.312.35
FORD, C. E. 635.648:576.312.35
Chromosome studies in the *Malvaceae*.
Rep. Brit. Ass. Blackpool, September 9–16, 1936 : p. 419. (Abst.)

There exists a wide range of haploid numbers in the genus *Hibiscus*. The two cultivated species *H. esculentus* and *H. cannabinus* included diploid and tetraploid races.

1127. DESHPANDE, R. B. 633.524.35:581.162.3:581.01:575.11
Mendelian segregation in *Hibiscus sabdariffa* L. in relation to the age of the F_1 at time of fertilization.
Indian J. Agric. Sci. 1936 : **6** : 1274–91.

An experiment to test whether there is any influence of the age at which F_1 plants are selfed on the segregation in the resulting F_2 progenies was carried out with *H. sabdariffa*. Two pairs of characters, narrow or broad leaf-lobe and red or green stem colour, the mode of inheritance of which was already known, were considered. A number of uniform F_1 plants having been selected in the case of each cross, the flowers were selfed daily on successive days over a considerable period. In the following season the seeds were sown separately for each F_1 plant and each day. Observations were taken when the plants could be easily placed in different phenotypic classes and the data analysed to see whether there was any large or

periodic variation in the F_2 ratios in respect of the two characters under study. The results indicated that though there were deviations, in the very great majority of cases these deviations were not significant, and were apparently random. The author concludes therefore that the F_2 segregation of the characters studied is not influenced by the time at which fertilization occurs in the heterozygous parent (i.e. F_1) plants. B. P. P.

1128. Nowell, W. 633.526.2:575(67.62)
Science and sisal production. Utilisation-agronomic research.
Planter 1937 : **5** (6) : 8–9.
Some of the problems connected with sisal production are reviewed. As probably nearly all the stocks in East Africa are derived by vegetative propagation from one parent, the variation obtained by growing seedlings is likely to prove of value. The first trials of this method at Amani have, however, not been encouraging though later work with seedlings from another species and from hybrids is more promising. This hitherto unrecognized species with desirable characters, named blue sisal, is now being tested on a large scale.

SUGAR PLANTS 633.6

1129. 633.61(94.3)
633.61:575
Cane sugar production.
Aust. Cane Sug. Industr. 1936 : Pp. 62.
Cane breeding is included in this brief but comprehensive account of cane sugar production in Queensland.

1130. Khanna, K. L. 633.61:575(54.1)
A preliminary note on the possibilities of breeding new varieties of sugarcane under North Bihar conditions.
Agric. Live-Stk India 1937 : **7** : 35–60.
The observation that the recently introduced Coimbatore seedling canes flowered freely in Bihar led the author to investigate the possibilities of breeding sugar cane varieties under Bihar conditions.
The study included time of anthesis and anther dehiscence, pollen shedding and viability, stigma receptivity, fertilization, seed development, viability of seed and raising seedlings. The results demonstrate clearly that sugar cane seedlings may be successfully produced in Bihar.

1131. Hill, A. G. 633.61:575(69.82)
An annotated catalogue of sugar cane varieties in Mauritius, present and past.
Bull. Dep. Agric. Mauritius 1937 : No. 13 : Pp. 37.
The first part of the list gives the varieties found in Mauritius to-day with notes on their parentage, origin, relative importance, synonyms and value as commercial or breeding canes. The second part deals with varieties known to have existed in Mauritius, or recorded as imported, in the past and now unknown.

1132. 633.61:608.3
Sugar cane. Benj. A. Bourne, of Clewiston, Fla., U.S.A. Plant Patent No. 203. October 27th, 1936.
Int. Sug. J. 1937 : **39** : 159–60.
A hybrid sugar cane whose immediate parentage is unknown (but with Louisiana Purple and Chunnee in its ancestry) is described. It is claimed to be very early, resistant to disease, possessing a high sugar content and with distinctive characteristics. The editorial note appended indicates some dissatisfaction with the data provided.

1133. H. M. L. 633.61:608.3
Plant patents and the sugar cane.
Int. Sug. J. 1937 : **39** : 171–72.
A discussion arising from the recent patenting of a sugar cane variety in the U.S.A. (Cf. Abst. 1132). It is pointed out that since cane breeding stations usually serve a whole country and are financed by the Government or the industry any protection which is needed for a cane variety is different from that provided by the United States Plant Protection Act. A more suitable means of recompensing the breeder would be through an international organization which would certify seed material and collect a royalty on a basis of acreage.

1134. Rosenfeld, A. H. 633.61–2.111–1.521.6:575.127.2
Frost resistance in sugar cane seedling progenies.
Int. Sug. J. 1937 : **39** : 175–76.
Frosts in early December at Giza shewed that varieties and seedlings having *Saccharum spontaneum*, *S. barberi* or *S. robustum* in their ancestry are more resistant than pure *S. officinarum* varieties.

1135. Storey, H. H. 633.61–2.8–1.521.6
The introduction of sugar cane varieties.
E. Afr. Agric. J. 1937 : **2** : 390–91.
The work of the Central Quarantine Station at Amani is briefly described with special reference to the procedure adopted for the introduction of sugar cane varieties. A list is given of varieties either resistant or believed to be resistant to mosaic disease and of some varieties found to be susceptible.

STIMULANTS 633.7

1136. Freeman, W. E. 633.71:575(69.82)
Black Shank resistance trials.
Annual Report on the Activities of the Government Tobacco Warehouse and the Progress of Tobacco Manufacture in Mauritius for the Year 1935. 1936 : 17–19.
Progress has been made in the selection of black shank-resistant strains from Amarello and the resistance of other varieties has been tested again.
Among selected strains of Amarello tested on estates, A. 8.5.2. seemed good.

1137. Maher, C. 633.73:575
Arabica coffee and the plant breeder.
E. Afr. Agric. J. 1937 : **2** : 298–304.
A general account of the principles and methods to be employed in the improvement of coffee.

1138. 633.73:575(67.62)
Coffee investigational work—1937.
Mon. Bull Coffee Bd Kenya 1937 : **3** : 46–50.
The programme for 1937 includes variety trials, selections of individual trees to be propagated both sexually and vegetatively and selection for resistance to coffee berry disease and to Elgon die-back. Crossing is also to be tried to combine vigour and resistance to coffee berry disease.

1139. McDonald, J. 633.73–2.483–1.521.6(67.62)
Report on coffee berry disease investigations in 1936.
Mon. Bull. Coffee Bd Kenya 1937 : **3** : 30–34.
A report on the experiments in progress on the resistance of various varieties of coffee and of grafts on different rootstocks to *Colletotrichum coffeanum* Noak. Four plots of Blue Mountain had a consistently low infection. Experiments on the effect of decreasing or increasing the supply of nitrogen shewed that this did not alter the original susceptibility. A number of other manuring, spraying and cultural experiments are being carried out.

FRUIT TREES 634

1140. 634:575(42)

New fruits. A survey of some of the more recent introductions to the list of tree and bush fruits.

Ctry Life, Lond. 1936 : **80** : p. xliv.

The qualities of some fairly recently produced English varieties of apples, pears, plums, red and black currants, raspberries and blackberries are briefly described.

1141. 634.11–2.7–1.521.6
634.11–1.541.11:575

Crane, M. B.

V. Breeding immune rootstocks.

Ann. Appl. Biol. 1937 : **24** : 188–95.

Massee, A. M.

VI. Entomological technique.

Ann. Appl. Biol. 1937 : **24** : 195–98.

Tydeman, H. M.

VII. Pomological selection of the new rootstocks.

Ann. Appl. Biol. 1937 : **24** : 199–205.

Roach, W. A.

VIII. Studies on possible causes of immunity.

Ann. Appl. Biol. 1937 : **24** : 206–10.

The substance of these four papers, which form part of a symposium on "the problems raised by the woolly aphis of the apple", is contained in the article reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 68.

CITRUS FRUITS 634.3

1142. 634.323:581.163:575.42
634.323:581.162.51

Wright, N.

Pollination and the seediness of Marsh grapefruit.

Proc. Agric. Soc. Trin. Tob. 1937 : **37** : 51–60.

In an investigation into the causes of seediness in Marsh Seedless grapefruit, flowers of the latter were pollinated with pollen from shaddock, rough lemon, West Indian lime, wild grapefruit, sour orange, Foster grapefruit, cocoa orange and seeded Marsh (i.e. Marsh producing seeded fruits). Other flowers were selfed by bagging, left unpollinated by emasculating and bagging or open pollinated (controls). Whether the female parent was seeded or seedless it was found that the source of pollen made no difference to the number of seeds per fruit, except in the selfed flowers; in the latter on seedless trees the number of seeds was about the same as in the unpollinated, 2·1–2·5, as compared with about 4 in the remaining seedless fruits. It is concluded that pollination by foreign pollen is not a serious cause of seediness in Marsh grapefruit and the author suggests that seedlessness in this variety is due to female sterility. In the shaddock or pomelo on the other hand it may be due to male sterility and in this form foreign pollen is of importance in producing seediness.

The seeded trees used in the present experiment were somewhat different in their characters from Marsh.

In conclusion the author stresses the need for selection of budwood from trees of known performance.

PALMACEOUS AND OTHER FRUITS 634.6

1143. Pieris, W. V. D. 634.61:575.42

Seed selection.

Leafl. Coconut Res. Scheme, Ceylon No. 1 : Pp. 4.

Instructions to coconut planters are given on the selection of mother palms and of seed nuts. In connexion with the selection of mother palms provision is made for yield records of individual palms.

SMALL BUSH FRUITS 634.7

1144. Olds, G. D. P. 634.774:575(91)

Further experimental work on pineapples.

Malay. Agric. J. 1937 : **25** : 38–57.

The results of experiments on the cultivation of pineapples made at the Pineapple Experiment Station, Singapore, from 1931–1935, are recorded. Only those of particular interest to plant breeders are reviewed here.

Of the varieties tested only the Ruby and the Sarawak are regarded as of potential commercial importance. A comparison of the Sarawak or Kew pine and the Smooth Cayenne variety has led to the conclusion that these are the same variety, the difference in size of the fruit being due to the environment.

About 130 selections chosen for improved fruit characters are being grown.

A cross was made between Sarawak ♀ x Singapore Canning pine ♂ and of the two surviving seedlings, one is definitely a hybrid with many very desirable features.

VEGETABLES 635

1145. Ramanatha Ayyar, V. and
Balasubramaniam, R. 635.657:581.44:575.11

Inheritance of branching habit in gram (*Cicer arietinum*).

Madras Agric. J. 1937 : **25** : 105–06.

The strain No. 468 isolated at Coimbatore from the local variety of gram and the Pusa type T. 6 and T. 8 bear branches from the ground level upwards, while No. 19, another strain isolated from the local variety has no branches until about the ninth node. In crosses of No. 19 with the other three strains the character basal branching behaved as a simple dominant, giving 3:1 segregation in F_2. The gene conditioning basal branching is designated *Br*.

The Pusa types branch more strongly than No. 468 and this is attributed to modifying factors.

1146. 635.659–2.456–1.521.6:575

Fahmy, F. 635.659–2.6–1.521.6:575

The selection of a rust immune strain of cowpea.

Bull. Minist. Agric. Egypt 1937 : No. 177 : Pp. 27.

A strain of cowpea (*Vigna sinensis*) immune to rust (*Uromyces vignae*) was selected from the American variety Progressive White. It proved to be also very resistant to root-knot caused by *Heterodera marioni*.

Part II. Foreign

STATISTICS 519

1147. Telegdy Kováts, L. v. 519.24
Matematikai módszerek a tudományos kutatás szolgálatában. 2. Egyes, hiányzó parcellák valószínü termésének kiszámítása a modern szabadföldi kisérleteknél. (**Mathematical methods in the service of scientific research. 2. Estimation of the probable yield of single missing plots in modern field experiments**).
Mezögazdas. Kutatás. 1937 : **10** : 1–7.
The use of the method of least squares in estimating the yields of missing plots in randomized block or latin square experiments is illustrated by an example.

BREEDING 575

1148. Blakeslee, A. F. 575
Twenty-five years of genetics, 1910-1935.
Mem. Brooklyn Bot. Gdn. 1936 : **4** : 29–40.
Taking 1900 as the real starting point of the science of genetics, the author considers the first 10 years to have been concerned mainly with Mendelian ratios. During the last 25 years the emphasis has been on the genes and chromosomes. During this period *Drosophila* has been the material *par excellence* for genetical work and three methods of investigation are mentioned as of outstanding importance; the aceto-carmine method for cytological technique, the artificial induction of mutation and the technique based on the discovery that the structures in the salivary glands of fly larvae are chromosomes with markings corresponding to the gene loci. The species problem has made considerable advances towards solution and it is suggested that genes and chromosomes will be the basis for future attack, with the possibility of a later conscious control of evolution.

1149. Bruman, A. J. 575:581.143.26.03
The place of iarovization in plant breeding.
J. Hered. 1937 : **28** : 31–33.
The possible significance of vernalization in plant breeding is discussed. It is pointed out that though the subject is as yet incompletely worked out, it does open up a new field for research.

1150. 575:633(43)
Saatzuchtwirtschaft Haid. (**The Haid farm of seed production**).
Bl. PflBau. PflZücht. 1937 : **14** : 70–80.
The organization, aims and results of plant breeding work at the farm at Haid are briefly described. Petkus rye is extensively cultivated for seed production. Improvement in disease resistance, baking quality, yield and resistance to lodging is aimed at for this crop. Yellow oats with higher yield than "F. von Lochows Gelbhafer" are being produced and a white grained variety has been bred. Work is also in progress with sweet lupin breeding, wheat and wheat-rye crosses and with soya beans, peas and vetches.

1151. Méneret, G. 575:633(44)
Sélection et expérimentation de plantes cultivées au centre de recherches agronomiques de Colmar en 1934 et 1935. (**Selection and experiments with cultivated plants at the centre of agronomic research, Colmar in 1934 and 1935**).
Sélectionneur 1936 : **5** : 107–21.
From the local varieties, a wheat, Vieux Ferrette, has been isolated and proved suitable to replace Alsace 22 and the local varieties on medium soils.
Variety tests have been carried out. Tests for baking quality by Pelshenke's method made

on F_2 and F_3 hybrids have indicated that the character is recessive but that there is transgression in the progeny of the F_2. The experiment has yet to be completed.
Experiments with barley included variety tests and observations on hybrids between local barleys and others of high quality with the object of producing a brewing barley that is early, high-yielding and resistant to lodging. Seven natural crosses are noted.
Tests of potato varieties, made with a view to replacing "Industry" have shewn that the best for this purpose are Erdgold, Konsuragis, Ackersegen and Cellini. Experiments were also made on lucerne and red clover.

1152. Aleksandrov, A. B. 575:633(47)
(Obtaining high yields of agricultural crops).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im.V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : **5** : 29–33.
An outline is given of the work which the All-Union Institute of Plant Industry has carried out of recent years upon wheat selection, lupins, potatoes, Jerusalem artichokes, sunflowers and rubber-bearing plants in endeavouring to obtain high yields, earliness, drought or disease resistance or a combination of some or all of these factors according to the requirements for the crop undergoing improvement.
Much of the work reported on is still in progress.

1153. *Konstantinov, [P. N.], Lisitsyn, [P. I.] and Kostov, D. 575:633(47)
(Some remarks on the work of the Odessa Institute of Plant Breeding and Genetics).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1936 : No. 11 : 121–30.
The authors, while acknowledging the enormous practical value of vernalization, point out the natural limitations of the method. The Odessa institute, it is stated, is apt to ignore the results of its own experiments or those of other institutes when they are not in agreement with its theories. Lysenko also denies or ignores the role of many undeniable factors such as viruses, genes, pure lines and hormones.
Other erroneous ideas of Lysenko are pointed out, such as the assertion that "no form can appear in the subsequent generations which is earlier than the F_1."
The new method of producing a new variety in a single year by intravarietal crossing is said to be based on a mere assumption not yet experimentally proved and the dangers of introducing such a method wholesale among the Kolhozes, as is now being done, are pointed out; experimental evidence is given against the assumption that the egg cell chooses the best of the male gametes ("marriage for love"). Lysenko's method of comparing the varieties is also erroneous. His new varieties, now being so rapidly multiplied, have not been compared with other varieties in the State variety trials and their superiority is not yet proved.
Another of Lysenko's methods is to subject winter wheat to "torment" by sowing in spring. The superior hardiness of the survivors is shewn to be capable of a genetical explanation simpler than the Lamarckian interpretation given by Lysenko.

1154. Lysenko, T. 575:633(47)
(Reply to the article "Some remarks on the Odessa Institute of Plant Breeding and Genetics" by P. N. Konstantinov, P. I. Lisitsyn and Dontcho Kostov).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1936 : No. 11 : 131–38.
In reply to the criticisms in the foregoing article (Cf. Abst. 1153) Lysenko denies the statement by these authors that "vernalization in 1936 had little or negative effect and on the whole reduced the wheat yields" and quotes letters from two Kolhozes in which yield increases were

* An extended summary of this paper is on file at the Bureau.

obtained. He also denies the statement that at Odessa results in disagreement with his theory are neglected and does not agree that the problem of potato degeneration had been elucidated in other countries before the work at Odessa; he claims that he has never denied the existence of virus diseases but stated that degeneration can be overcome by his methods whether it is due to virus or not; virus diseases he regards as unimportant in connexion with potato degeneration.
The statement of the critics that the new varieties obtained by intravarietal crossing are not superior in yield is also contradicted and ascribed to mere ill-will on the part of the critics. He further states that the method of intravarietal crossing is one of the main achievements of the institute and almost all the work of the institute is now based on it; it is being applied on a mass scale in hundreds of collective farms and the enthusiasm of the workers is cited in support of the method.
The criticisms are all ascribed to a desire to bring the Odessa school into disrepute and not worthy of a direct reply.

1155. Kovalev, I. N. 575:633(47)
(Results of the work of the Krasnodar Breeding Station during the last five years).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 12 : 11–14.

Some of the new varieties produced by the Krasnodar station that have already attained wide distribution are Stavropolka 0328, a rust-resistant winter wheat, outyielding Kooperatorka by 3–7 centners per ha. Other varieties resistant to all three rusts have been produced and are distinguished by unusually high yield, grain of high quality and resistance to shedding; also winter varieties of *T. durum*. It is hoped to have constant *Triticum-Agropyrum* hybrids in 1940, and by crossing spring with winter varieties improved rust-resistant spring wheats yielding 16 centners per ha. as compared with 10–11 centners in the standard varieties have been obtained.
A new high-yielding winter barley of improved winter-hardiness and standing capacity has been produced. Other productions are forms of *Phaseolus* resistant to bacterial blight and of gram resistant to *Aschochyta*, and earlier soya beans with improved yields.

1156. Lebedinskii, B. N. 575:633(47)
(The Glavsakhar plant breeding stations undertake to present new record varieties to industry in the next few years).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 11 : 7–8.

A brief note on the programme of the stations in regard to future work. Among the aims selected are: for wheat, the production of types resistant to cold, rust and lodging; for peas, the production of high-yielding forms resistant to disease; for lentils, the production of a new variety with high yield and of good quality.

1157. 575:633(47)
Tzitzin, N. V. 633.2:575(47)
(Brief report on work of the breeding section of the Siberian Institute of Grain Husbandry).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 9 : 5–19.

The valuable qualities of hardiness and tolerance in which *Agropyrum* is unique among cereals are transmitted and even increased in crossing with wheat, as is its unusually high protein content, some of the hybrids having exceeded *Lutescens* 062 by as much as 24 per cent in loaf size.
A new method has been introduced in dealing with the hybrids, consisting in crossing the sterile hybrids with the fertile hybrids and intercrossing the hybrid forms, and is altogether found to be a more promising method than back-crossing. True-breeding perennial lines have now been isolated from the hybrids; they proved highly drought-resistant but not very winter-hardy.

Improved strains of spring wheats suitable for the extreme north have been produced by selection from the local Siberian wheats, e.g. the new variety Smena, which has matured and given good yields even in very cold wet years. A greatly improved new variety of *T. durum*, *Leucurum* 05383, has also been selected, as well as a new hybrid of Milturum 0321 x Kitchener which is free from lodging, shedding, rust and smut.
Many valuable new oats have been produced by crossing with wild forms, some of them exceeding the standard by 15–18 per cent in yield. An improved barley, named Boets, has been produced by selection from the local barley; it is superior in both yield and drought resistance and is not damaged by late frosts.
Improved strains of millet have been selected and the local Siberian strains of legumes, peas, lentils, *Phaseolus*, other beans and gram, once very fine but now almost lost or impure, have been collected, whereby it has been possible to isolate certain very promising lines, including an excellent pea named Stambovyi.

1158. 575:633(51)
HAYES, H. K. 63.00.15(51)
Agricultural research in China.
Science 1937 : **85** : 321–25, 347–50.
A brief survey of the organization and work on plant breeding is included. The breeding of improved varieties is the best developed of the different lines of agricultural research work.

1159. TSCHERMAK-SEYSENEGG, E. 575:633:007
Z vlastní vědécké dílny pro zušlechťování rostlin. (**My work on plant breeding**).
Věstn. čsl. Akad. Zeměd. 1936 : **12** : 570–74.
A review of the author's work on plant breeding, extending over nearly forty years. The varieties of cereals he has bred are mentioned and also his work on *Leguminoseae*, *Primula* and *Cucurbita*. Genetical topics include xenia, especially in barley and wheat, cryptomery, constant, fertile, interspecific and intergeneric hybrids in cereals, hybridogenous pseudoparthenogenesis and heterosis.

1160. JUR'EV, V. A. 575:633.1(47)
(**Pedigree varieties**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : 10–11.
Brief descriptions are given of a number of improved varieties of spring and winter wheat, barley, oats and maize raised by the author by individual plant selection or mass selection.

GENETICS 575.1

1161. 575.1:030.8
A glossary of genetic terms.
J. Hered. 1937 : **28** : 71–80.
This glossary is published in the Journal of Heredity in an admittedly imperfect form, with a request for emendations and corrections. It is intended ultimately to publish it in its final form as a booklet.

1162. ARANČUK, M. 575.115:581.02
(**The influence of the environment on the dominance of recessive characters**).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1936 : No. 11 : 165–68.
F_1 hybrids of *Pisum arvense* x *P. sativum* were grown under different sets of experimental conditions. When the hybrids were sown in May in a cold frame, or in the open with normal day or with 8, 10, 12 and 14 hours daily illumination, tall stem, red flower and wrinkled seed were dominant. When sown earlier in the year in the hothouse, however, some hybrids were tall and others short, some had red and others white flowers, some small wrinkled seeds

and others large sugary seeds. Similar reversal of dominance was obtained in some of the hybrids grown with additional artificial illumination.
Dominance is thus seen to be dependent upon the interaction between the external and internal environments.

1163. Lysenko, T. D. 575.12
(Intravarietal crossing of self-pollinated plants).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 11 : 13–27.
A reproduction of the article reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 897.

1164. 575.12
Lysenko, T. D. 575:633(47)
(How we are fulfilling our obligation).
Bjulleten' Vsesojuznoi Akademii C.-X Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : 5–9.
The new wheat varieties produced on the principle of phasic development occupied one of the first places as regards yield in 1936. All three (1163, 1160 and 1055) were earlier than the other varieties tested. Lines of greater hardiness have been isolated by sowing partially vernalized seed over the winter and selecting the surviving plants.
The yields of hybrids obtained from various intervarietal crosses are reported and are almost all in excess of the parental yields; e.g. *melanopus* 0122 x *melanopus* 069 which gave 17·3 centners per ha. where 0122 gave 13·0 and 069 gave 14·2. As a result of intravarietal crossing yield increases up to 4 centners per ha. are reported, especially in old varieties such as Girka. This method is therefore being introduced on a large scale into the collective farms.
By regulating the conditions under which certain developmental stages are passed a spring form of the winter wheat Kooperatorka has been obtained. This, it is claimed, is an example of the control of the process of mutation and it is hoped to solve other problems of practical breeding by the same method.

1165. 575.17
575.116.4
Winge, Ö. 576.312.32:578.08
Et epokegørende Fremstød i Kromosomforskningen. **(An epoch making advance in research on chromosomes).**
Nat. Verd., Kbh. 1935 : No. 5 : 199–207.
A concise and aptly illustrated account for Danish readers of the discoveries relating to chromosome structure that have been made from a study of the salivary gland chromosomes of *Drosophila*. The importance of the findings as evidence for the linear arrangement of genes and in other respects (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 599) are indicated.

1166. Sinnott, E. W. 575.172
The genetic control of developmental relationships.
Amer. Nat. 1937 : **71** : 113–19.
After giving instances of the genetic control of fruit shape in the *Cucurbitaceae* (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 807), the author suggests that genes work by controlling the relationships between different processes, e.g. growth rates and possibly even chemical change; they are therefore to be considered as regulators rather than as activators.

1167. Roemer, Th. 575.22:633
Die Bedeutung des Gesetzes der Parallelvariationen für die Pflanzenzüchtung.
(The significance of the law of parallel variation for plant breeding).
Nova Acta Leop. 1936 : 4 : Neue Folge : 351–65.
Vavilov's law of parallel variation is stated and illustrated with numerous examples of morphological and physiological characters in different groups, including forest trees, fruits and *Gramineae*. Its significance for plant breeding is that it makes it possible to predict the occurrence of hitherto unknown forms by analogy with related groups. The German Hindukush Expedition of 1935 had this principle in mind.

1168. Shkvarnikov, P. K. 575.24:581.032:576.312.36
(The influence of increased temperature on the frequency of chromosomal mutations in *Crepis* under different conditions of relative humidity of the air).
Biologičeskii Žurnal (Biologischeskij Zhurnal) 1936 : **5** : 887–94.
The effect of high temperature (40° C.) on seeds of varying degrees of moisture was investigated. The resulting plants were examined cytologically and shewed a marked increase in irregularity with increase of the moisture. It is concluded that a rise in moisture content, like a rise of temperature, increases the vital processes of the cell which in turn are evidently connected with the mutations. These, in addition to structural irregularities, included tetraploid and even octoploid cells or sectors in the root, shewing the irregularities to have occurred some time after the application of the high temperature and to be evidently secondary phenomena following upon the direct effect of the treatment.

1169. Stubbe, H. 575.243:535.61–31
Die Erzeugung erblicher Veränderungen bei Pflanzen durch Bestrahlung mit ultraviolettem Licht. **(The production of hereditary alterations in plants by irradiation with ultra-violet light).**
Umschau 1936 : **40** : 911–14.
It has been shewn that the mutation rate in *Antirrhinum* can be considerably raised by irradiation with ultra-violet light, the method used consisting in pollinating emasculated flowers with irradiated pollen and examining the second generation for mutations. The strongest doses of light of wave-length 265 mμ produced a threefold increase in the mutation rate, while the strongest doses of wave-lengths 297 mμ, 303 mμ and 313 mμ produced five- or six-fold increases. Above 313 mμ the effect diminished rapidly. Visible light had no effect on the mutation rate.
Ultra-violet light must therefore be considered as a possible factor in the production of natural mutations, but in this respect its low penetration must be remembered, especially in *Antirrhinum*, in which the anthers are shaded by the corolla. Mutant forms in which the corolla is deeply dissected and the anthers therefore exposed afford a means of testing the possible role of ultra-violet light in nature, for if it is effective in inducing natural mutations, such forms should have a higher mutation rate than normal.

1170. King, R. L. and Beams, H. W. 575.243:578.088.2:576.356
Ultracentrifuging as a possible means of causing chromosome aberrations.
Genetics 1937 : **22** : p. 198. (Abst.)
Experiments are in progress to see whether the chromosome fragments produced by ultracentrifuging persist as such. Another result of such treatment is displacement of both the daughter groups of chromosomes at anaphase to one end of the cell, which may result in tetraploidy.

1171. Dikunov, P. A. 575.243:581.036.1
(Variability of plants as a consequence of the action of temperatures).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 11 : 58–59.
The author holds that the effects produced by climate or temperature acting upon the plant during the vegetative or resting period, may be only slightly noticeable in the first generation but may lead to numerous mutations in the second or subsequent generations. Effects of this kind were produced in the "Triumph" bean by the action of temperature—changes being recorded in the type of plant (dwarf or tall) and of pod, in the time of ripening, in yield and in the shape and colour of the seed. Whether an alteration in the chromosome number has accompanied the above changes has still to be determined.
The author also claims to have induced sterile varieties of potatoes to set fruits and to produce normal seed subsequently on selfing.

1172. Daniel, L. 575.25
Les Cratægomespilus. (**The Cratægomespilus**).
Rev. Hort. Paris 1937 : **109** : 446–49.
The occurrence of sectors of smooth red skin on the fruits of *Cratgæomespilus* or of a gradual transition from the normal colour and texture of the medlar to that of the hawthorn is noted and is taken as disproving the hypothesis that the *Cratægomespilus* is a periclinal chimaera.

1173. Jones, D. F. 575.25:581.143.32
Somatic segregation in relation to atypical growth.
Proc. Amer. Phil. Soc. 1937 : **77** : 411–16.
A general survey of the problem (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1245). Since linked genes are not always affected together it is suggested that a form of somatic segregation occurs that does not involve chromosome aberration.

1174. Schmidt, M. 575.252:634.1/2
Somatische Mutationen beim Kern- und Steinobst und ihre züchterische Bedeutung. (Sammelreferat). [**Somatic mutations in pome and stone fruits and their significance in breeding. (Survey of literature).**]
Züchter 1937 : **9** : 81–91.
The number of fruit varieties in cultivation which have originated as bud sports is witness to the importance of these mutations. When such sports represent an improvement over the original variety in one or more characters—an object only achieved with great difficulty by ordinary breeding methods—their value is obvious. At the same time the danger of bud sports inferior to the parent variety must not be forgotten.
The bud sports already known in stone and pome fruits, involving colour and structure of the skin, flesh, size and shape of the fruit, time of ripening, taste, number of seeds and pericarp colour, size, insertion and time of fall of the leaves, leaf colour, habit of growth, fertility, behaviour towards weather and parasites, reverse mutations and chimeras are briefly reviewed.

1175. Kagawa, F. 575.255:576.356.5:633.491
(**Chromosome chimera formed by decapitation-callus method in a plant of genus *Solanum***).
Proc. Crop Sci. Soc. Japan 1936 : **8** : 431–38.
The method of taking shoots from the callus produced by decapitation was practised with *Solanum gracile* (n = 12) in the spring of 1934 and out of 80 shoots, two shoots shewing n = 24 in the pollen mother cells were obtained from different plants. In the following year, however, certain of the plants obtained by vegetative propagation from these apparently tetraploid plants shewed n = 12 in the pollen mother cells. It is concluded therefore that the "tetraploid" shoots were not pure tetraploids but were chimeras made up of diploid and tetraploid tissue.
Outwardly, one of the "tetraploid" shoots grown in 1934 had the characters of a diploid and it is suggested therefore that it was a periclinal chimera with the diploid tissue outside.

1176. Mittmann, O. 575.4:575.24:519.2
Über die Schnelligkeit der relativen Vermehrung vorteilhafter Mutationen. (**On the rate of the relative increase of advantageous mutations**).
Nachr. Ges. Wiss. Göttingen 1936 : **2** : 107–27.
Formulae are derived to express the rate of spread of an advantageous mutation under two different types of selection and with sexual and asexual reproduction. The results are illustrated in graphical and tabular form.

1177. Tschulok, S. 575.41
Über Darwin's Selektionslehre. Historisch-kritische Betrachtungen. (**On Darwin's selection theory. Historical critical considerations**).
Vjschr. naturf. Ges. Zürich 1936 : **81** : No. 26 : 1–68.
The author traces the development of Darwin's theories on evolution throughout Darwin's life, with quotations from his works and letters. It is shewn that Darwin was aware that evolution had occurred before he developed the idea of natural selection.

The concept of the origin of species prevailing at the time was, however, the physico-theological one, according to which they had been specially created and the facts of adaptation were taken as evidence of the wisdom of the Creator. In answer to this Darwin had to produce an explanation for adaptation. This was provided by natural selection, but Darwin was led astray by his pre-occupation with the physico-theological idea and failed to separate the two problems: (1) had evolution occurred? and (2) if so, by what means? The facts from morphology, systematics, palaeontology etc. which Darwin brought forward present clear proof that evolution has occurred, but they do not, as he suggested, shew that it occurred by natural selection. '

CYTOLOGY 576.3

1178. Allen, C. E. 576.3
Twenty-five years of cytology, 1910-1935.
Mem. Brooklyn Bot. Gdn. 1936 : **4** : 11–19.
The developments in cytology are very briefly reviewed. The advances made in the knowledge of cytoplasmic structure, the problem of the nucleolus, the morphology of the chromosomes, sex chromosomes, the chromosomes of the salivary glands of flies, chromonemata, chiasmata and fragmentation are mentioned.

1179. Nebel, B. R. and Ruttle, M. L. 576.312.38
Chromosome structure.
Genetics 1937 : **22** : p. 202. (Abst.)
According to these authors chromosomes, studied in *Tradescantia, Trillium, Hordeum, Secale* and the Orthopteran *Dissosteira*, contain four threads arranged in pairs to form the chromatids. Multiplication of the threads occurs at metaphase. At meiosis the leptotene threads are tetra-partite and multiplication occurs at first metaphase, anaphase or telophase.

1180. Câmara, A. 576.356.2:537.531
Éléments pour l'étude de la fragmentation chromosomique. (**Materials for the study of chromosome fragmentation**).
Rev. Agron. Lisboa 1936 : **24** : 176–80.
Aloe arborescens L. was treated with X-rays and the effect on meiosis observed.
The occurrence during the early stages of pachytene of large fragments and the occurrence of very similar fragments during the later stages, but still before diplotene, and the constancy of their position in the cell leads the author to the conclusion that there are definite points of breakage in certain chromosomes.

1181. 576.356.5:575:633
Schlösser, L. A. 635.64:576.356.5–18
Grenzen und Möglichkeiten der Ausnutzung von Polyploidie in der Pflanzenzucht. (**Limitations and possibilities of the utilization of polyploidy in plant breeding**).
Forschungsdienst 1937 : **3** : 69–82.
Further quantitative studies on diploid and tetraploid races of *Lycopersicum racemigerum* and *L. cerasiforme* are presented (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1054). The tetraploids were retarded in development being behind the diploids in times of germination, flowering and ripening of the first fruit. With regard to dimensions the tetraploids surpassed the diploids in area of the cotyledons, length and diameter of the hypocotyl and cell size and at three and a half weeks the tetraploids were considerably taller than the diploids. The degree of difference between 4n and 2n plants was different in the two species. The tetraploids had larger fruits and the increase was greater in *L. cerasiforme* though in this species the tetraploid shewed a greater reduction in the number of seeds per fruit as compared with the diploid. The tetraploid seeds were larger and heavier than the diploids, the increase being greater in *cerasiforme*. The changes in size mentioned were often accompanied by changes in shape, cotyledons and seeds being relatively broader and thicker in the tetraploids.

Data were obtained on fresh weight, dry weight and weight of ash and in agreement with the previous finding that the tetraploids had a lower osmotic pressure it was found that dry weight and ash weight formed lower percercentages of fresh weight in tetraploids than in diploids. Expressed in grammes, however, the fresh, dry and ash weights of the tetraploids were all greater than the corresponding weights of the diploids. Here again the relative increase in the tetraploid as compared with the diploid was different in the two species and also at different ages of the plants.

The results shew that experiments should be performed, especially with fodder plants and vegetables, to test the practical utility of (auto-) polyploidy in increasing yields. As disadvantages have to be considered the retardation in development and the lower frost and drought resistance of polyploids, a consequence of their reduced osmotic pressure. The author considers that the reduced osmotic pressure will be a drawback in the sugar beet, for it implies a lower sugar content. The possible use of aneuploid forms in asexually reproduced plants is also discussed.

SEX CONTROL 577.84

1182. Minina, E. G. 577.84
(Sex control in plants).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) **1936** : No. 9 : 39–40.

Experiments are described in which maize and cucumber plants were grown with a sufficient supply of P and K salts from the start, nitrogenous manures being applied gradually. This treatment was found to increase the number of female inflorescences in maize and of female flowers in the cucumber, whereby the final yield was materially raised. By similar gradual application of potassium salts the proportion of male flowers was increased.

BIOLOGICAL TECHNIQUE 578

1183. La Cour, L. 578.6
Improvements in plant cytological technique.
Bot. Rev. **1937** : **3** : 241–58.

A valuable survey, based on the author's wide experience, of methods now in use, including some very recent improvements. An extensive bibliography is provided.

BOTANY 58

1184. Sears, E. R. 581.162.52
Cytological phenomena connected with self-sterility in the flowering plants.
Genetics **1937** : **22** : 130–81.

The plants studied are divided into three classes according to the mode of action of the incompatibility factors.

The first class comprises those in which germination of pollen is decreased, the plants studied being *Brassica oleracea* var. *italica* (broccoli) *Raphanus sativus, Pelargonium hortorum* and *Secale cereale.* The tendency in this group is towards a localization of the incompatibility reaction in the stigma and in broccoli removal of the surface layer of the stigma as well as bud-pollination permitted self-fertilization.

In the second class germination is normal but pollen tube growth is inhibited in the style. Examples studied were *Petunia violacea, Abutilon hybridum, Nicotiana Sanderae, Linaria reticulata, Nemesia strumosa* and *Tolinica Menziesii.* The distance covered by incompatible pollen tubes varied in the different species.

In the third class the pollen tubes grow normally and reach and fertilize the ovules, but no seed is developed. The only example of this class was *Gasteria,* in which it was found that the incompatibly fertilized ovules degenerated at the same time as those unfertilized.

It is considered that self-sterility in all the higher plants so far investigated can be interpreted on the basis of a reaction between haploid male tissue and diploid female tissue and of the kind involved in immunity in animals. Differences within and between classes are caused by localization of the reaction in different parts of the pistil or by its action at different times. In the first class the reaction occurs before the pollen germinates, in the second when the pollen tube is growing in the style and in the third when the pollen tube reaches the ovule. In the third class the integuments of the ovule are concerned in the reaction, which prevents the incompatible tube from stimulating them to development.
Some observations were made on the genetics of self-sterility and in broccoli, it is suggested, two series of oppositional factors are present, each being composed of factors of varying inhibitory potency. The occurrence of stimulating factors (Cf. "Plant Breeding Abstracts", Vol. I,.Abst. 146) is considered improbable on physiological grounds.

1185. *Nilov, V. I. 581.192:575:633.81
(Regularities in the chemical variability of plants).
Bull. Appl. Bot. Leningrad 1936 : Ser. III (13) : 5–29.
A continuation of earlier work (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 65) has confirmed the observation that within a pure species the nature of the compounds present remains the same, though their quantity and proportions may, however, vary greatly. Certain exceptions to this rule are mentioned but are thought to be ascribable to hybridity on the part of the species. It is therefore possible to engage in hybridization within the species to increase the content of any product without the risk of producing any other, undesirable product; if, however, it is desired to produce a new compound distant hybridization is clearly necessary. Great variation was detected in the essential oil content of different strains of a number of aromatic plants, and in the oil content of olives and lupins, the sugar content of peaches and the oil content of their kernels, the alkaloid content of pyrethrum and of belladonna. The conclusion is reached that by simple selection it should be possible to produce forms of the above plants with greatly increased contents of the desirable compounds, and by hybridization between suitable pairs still greater improvements may probably be effected, so producing forms of quite unfamiliar richness; even some of the types already observed are sufficiently remarkable, such as lavender with 11 per cent oil, fennel with 13 per cent, peaches with 15 per cent sugar and lupins with 20 per cent oil and low alkaloid content.
Related species in the genus may contain quite different compounds and conversely the same compound, e.g. camphor, may be found in widely separated and unrelated species. Thus by crossing *Ocinum canum* containing camphor with *O. gratissimum* containing phenol (eugenol) hybrids were obtained which contained both these compounds, camphor in amounts intermediate between the two parents and eugenol sometimes in excess of either. Some of these latter hybrids moreover had a total oil content much in excess of *O. gratissimum* and hence give a very greatly enhanced output of eugenol, for which purpose their cultivation is recommended.
Some hybrids contained large quantities of citral, a compound absent in both parental species. It is thought possible that new compounds may also arise in a species as the result of mutation.

1186. Vavilov, N. I. 581.9:575:633
Světová střediska vzniku kulturních rostlin v zemědělství. **(The world centres of origin of the cultivated plants of agriculture).**
Věstn. čsl. Akad. Zeměd. 1936 : **12** : 574–78.
A brief account of the author's views on this subject and of its importance in plant breeding. Now that the great diversity of material has been surveyed the point of interest is the selection of parents to obtain the best combinations for breeding.
Concluding the article the author points out that there are no crises in scientific questions but that problems emerge every day and they will only be solved by international scientific co-operation.

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* An extended summary of this paper is on file at the Bureau.

1187. 63.00.14(47)

(Plans of work of the institutes for 1937).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 10 : 36–38.

The plans of work of the various research institutes for the year 1937 are outlined.

1188. 63.00.14(47)
575:633(47)

(Results of the work of the research institutes in the first half of 1936).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 9 : 9–14.

A brief survey is given of the lines of work engaged in by the Institute of Plant Industry, Institute of Plant Protection and other agricultural research institutes, including the Michurin Fruit Institute. Among the new achievements figure the first known hybrid between apple and pear and between red currant and gooseberry and two high quality frost-resistant vines.

FIELD TESTS 631.421

1189. Bachér, I. 631.421

Planläggning av komplicerade försök. **(The laying out of complicated experiments).**

Beretn. Nordisk JordbrForsker. Foren. 5th Kongr. København Juli 1935 : 4–7. Hefte : 329–42.

This is a description of methods of field trials which involve more than one set of comparisons. The split-plot lay-out is described, and also more complicated designs involving factorial analysis, following the methods of Fisher and Yates. J. W.

1190. Olsen, H. K. 631.421(48.9)

Raekkemetoden i dansk lokal forsøgsvirksomhed. **(The row method in Danish local field trials).**

Beretn. Nordisk JordbrForsker. Foren. 5th Kongr. København Juli 1935 : 4–7. Hefte : 318–28.

The method of trial described is one in which a number of varieties are set out systematically in a row, with a number of repetitions. The calculations, which involve a correction for fertility in the case of each plot by taking deviations from the mean of three adjoining plots, are described in detail. The question of the significance of the difference between varietal averages is not considered. J. W.

1191. Papadakis, J. S. 631.421:519.24

(A statistical method for field experiments).

Bull. Sci. Inst. Amélior. Plantes Salonique 1937 : No. 23 : Pp. 30.

The author describes a method which he has evolved for reducing the experimental errors of field trials, and at the same time producing better estimates of the mean yields of the treatments or varieties, based upon correcting for the correlation between adjoining plots. No theoretical demonstration of the validity of the method is given. J. W.

1192. Papadakis, J. S. 631.421:519.24

(On the breadth and length of plots in field experiments).

Bull. Sci. Inst. Amélior. Plantes Salonique 1937 : No. 24 : Pp. 24.

The author discusses generally the question of the length and breadth of plots in field experiments, and describes some of his own experiments in this connexion. The variability of the absolute yields was not reduced by increase in length or width beyond 2 metres. With narrow plots the error, using the author's methods, is diminished by the occurrence of correlation between contiguous plots. J. W.

1193. Przyborowski, J. and Wileński, H. 631.421:519.24
Metoda przeprowadzania doświadczeń z zastosowaniem poletek wzorcowych. (**The check-parcel method**).
Wydaw. Sekcji Nasiennej Przy M.T.R. w Krakowie i Zakładu Hodowli Roślin i Doświadczalnictwa U.J. Kraków 1937 : No. 16 : Pp. 24.
The method, here called the check-parcel method, of arranging a series of varieties or treatments in a field experiment in a systematic way with interspersed controls, is here subjected to a mathematical treatment, and the conclusion is reached that for validity the treatments must be randomized, preferably within replications. The authors propose to increase the efficiency of the method of analysis by making use of the correlation between plot yields due to fertility gradients. J. W.

PLANT DISEASES 632

1194. McNew, G. L. 632.3:576.16:633.15
Isolation of pathogenic variants from pure cultures of *Bacterium stewarti*.
Phytopathology 1937 : **27** : p. 135. (Abst.)
Variants were derived from pure cultures of *Bacterium stewarti* by single colony isolation, and included types both more and less virulent than the parent culture.

1195. Savulescu, T. 632.3–1.521.6:615.37
L'immunité aux maladies bactériennes des plantes. (**The immunity of plants to bacterial diseases**).
Published in France by Imprimerie Soulisse-Martin, Niort 1936 : Pp. 77.
A comprehensive survey of the work already done on plant immunity with regard to bacterial diseases. After a short introduction the problem is discussed under the headings (A) resistance of plants to bacterial diseases, which includes mechanical resistance and physiological resistance; the inheritance of resistance is briefly treated in the last section: (B) the acquired immunity of plants to bacterial diseases which includes acquired immunity to superinfection, vaccinal immunity, serological immunity, anaphylaxis and immunity in plants and bacteriophages.
Although the knowledge of the mechanism of immunity in plants is less complete than in the case of animals it is clear that the same laws regulate the phenomena.

1196. Müller, K. O. 632.411.4:576.16:633.491
Die Variabilität der Virulenz und der biologischen Spezialisation bei dem Erreger der Kartoffelkrautfäule, *Phytophthora infestans*. (**The variability of the virulence and biological specialization in the pathogen of potato blight *P. infestans***).
Naturwissenschaften 1936 : **24** : 552–57.
The research that has centred round the problem of biological specialization in *P. infestans* is reviewed and evidence is cited to shew that biological specialization cannot be induced by the host plant, though the latter may affect the vitality of the parasite favourably or otherwise according to the particular variety acting as the host. Nevertheless no instance is recorded here of a particular line of *Phytophthora* extending its range of host species as a result of cultural methods employed either to decrease the vitality of the fungus or to promote its recuperation after a period of lowered vitality.
The still unexplained problem of the close relationship existing between the S-race and the W-varieties is in the author's opinion, best considered in the light of the selection theory, since Lamarckism does not offer a satisfactory solution, and the high degree of constancy maintained by the fungus as regards biological specialization in cultural experiments would seem to exclude the possibility of mutation as a source of new races.
In discussing the validity of the criteria available for demonstrating the existence of physiological races of *P. infestans* a warning is given that all differences in virulence and vitality of the fungus must not be regarded as necessarily racial distinctions.

1197. 632.451.2
SCHULTZ, W. 633.15–2.451.2–1.521.6
Maisbeulenbrand (*Ustilago zeae*). [**Maize smut (*U. zeae*)**].
Forschungsdienst 1937 : **3** : 143–51.
Among the topics covered in this review are heterothallism, resistant varieties, the difficulties in breeding occasioned by the numerous physiological forms and the production of the latter by mutation.

1198. HASSEBRAUK, K. 632.452:633.1
Die Ergebnisse der Getreiderostforschung der letzten 10 Jahre. (**The results of cereal rust research in the last 10 years**).
Forschungsdienst 1936 : **2** : 503–17, 568–81.
Among the topics discussed in this exhaustive survey are heterothallism, hybridization and mutation, specialization, systematics, the various factors influencing infection and spread, resistant varieties and the inheritance of resistance. The bibliography gives 633 references.

ECONOMIC PLANTS 633

1199. FUCHS, W. H. 633–2.1–1.521.6:578.081
Die Bestimmung der physiologischen Resistenz. (**The determination of physiological resistance**).
Forschungsdienst 1936 : **2** : 294–310.
A survey of methods of determining resistance to adverse factors such as cold and drought. They are divided into direct methods, in which the adverse factor itself is brought into action and indirect methods, in which resistance is estimated through one or a group of characters which influence it. The relative merits of the two types of methods are compared. It is suggested that there is often a connexion between resistance to different factors.

CEREALS 633.1

1200. HEINISCH, O. 633.1:581.142:575
Die Dauer der Keimreifung der Getreidearten als erbliche Sorteneigenschaft. (**The length of the maturing process of the seeds of cereals as a hereditary varietal character**).
Z. Zücht. 1937 : A **21** : 294–305.
Extensive studies have been made on the period which must elapse before freshly harvested grain will germinate and have shewn that the duration and the rhythm of the maturing are characteristic of the variety. Their significance in breeding work is discussed.

1201. 633.1.0014
633.11:575(47.9)
ZOLOTNITSKAJA, S. Ja. 633.16:575(47.9)
(**Winter varieties of crops in Transcaucasia**).
(The varieties of crop plants in Transcaucasia. No. 1. Grain crops). Lenin Acad. Agric. Sci., Inst. Pl. Ind., Dep. Var. Test., Leningrad 1935 : Ser. V(4) : 91–204.
This paper deals mainly with the distribution and the area under various types of wheat and barley in Transcaucasia. The use of local types as material for selection and the possible value of crosses between *Triticum durum* and soft wheats are mentioned. There are also brief references to the early work on cereals at the Azerbaijan and Armenian Breeding Stations (Cf. "Plant Breeding Abstracts", Vol. VII, Absts. 612 and 613) with occasional references to successful varieties such as the wheats *Apulicum* 77 2 and 82/1 and *Erythrospermum* 1335/2. Much space is devoted to variety testing as practised under the net system with its regional centres for trials of crops; the main varieties of winter wheat and barley that have been tested are cited and the best of them described.
A bibliography is added.

1202. WAGNER, S. 633.11(49.4)
Die Beschreibung der schweizerischen Weizensorten (*Trit. vulg.* Vill.). (Grundlagen für ein schweizerisches Getreide-Sortenregister). [**The description of the Swiss wheat varieties (*T. vulgare* Vill.). (A basis for a Swiss cereal variety register)**].
Landw. Jb. Schweiz. 1937 : **51** : 121–42.
The characters necessary for the identification of varieties are described. They include characters observable during the three stages of development; from germination to flowering, from flowering to ripening and in the mature plant.

1203. NICOLAS, G. and CHALAUD, G. 633.11:575(44)
Le centre de sélection et de génétique de l'Institut agricole de l'Université de Toulouse en 1935 et 1936. (**The centre for selection and genetics of the Institut agricole de l'Université de Toulouse in 1935 and 1936**).
Progr. Agric. Vitic. 1936 : Pp. 7 ; 1937 : Pp. 8.
The testing of new varieties and hybrids has been continued. The weather conditions of the season 1934–35 were responsible for the low yields of the 1935 harvest.
The hybrid of Inversable x Rieti 3″ is especially noticed. During the 1935–36 season the cultivation of several varieties, including Zara and Rieti x Inversable Ia has been given up because of various defects.

1204. 633.11:575(47)
633.15:575(47)
KOVALEVSKII, L. I. 635.655:575(47)
(**New varieties of agricultural plants**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : 12–14.
Several winter wheat varieties produced by the author and characterized by early maturity, high yield, resistance to brown rust, lodging and shedding and with large vitreous grain are named. Some of these "varieties" consist of artificial populations consisting of mixtures of a number of lines or hybrids all resembling one another in morphological features. Among spring wheats an improved strain of Arnautka (*Triticum durum hordeiforme*) yielding up to 20 centners per ha. and possessed of resistance to fungal, Hessian and frit fly attack and to shedding and lodging, is the most outstanding.
Maize and soya bean varieties with greatly improved yields have also been produced.

1205. 633.11:575(47.4)
RUUBEL, N. and HALLER, E. 633.11 Kuusiku
Uus talinisu sort "Kuusiku nisu." (**The new winter wheat variety "Kuusiku wheat"**).
Agronoomia 1936 : No. 2 : 63–75.
The winter wheat variety Kuusiku (Kuusiku 75) is a pure line selection from a local variety at Kuusiku where Mr. K. Liidak (Liideman) had selected from a field which had suffered from winter killing about 200 plants which proved to be uninjured. Among those 200 lines the line Kuusiku 75 proved the best yielder and the most winter-hardy. According to data of the State Agricultural Experimental Station the Kuusiku variety is a better yielder than the widely grown Luunja variety.
The distinctive property of the Kuusiku wheat is great energy in germination, which in damp weather accelerates the growth of the grains even in the ear. Kuusiku wheat is proof against winter killing. In view of its winter-hardiness its yield is rather reliable, fluctuating between 1829 and 2255 kg., according to the results of the State Agricultural Station over a period of eight years. The average yield is 2082 kg. During the same period the yield of

Luunja wheat fluctuated between 1214 2162 kg., and of Svea even between 1048–2157 kg. The maximum deviation in the yield of grain has been in eight years: of Kuusiku 12 per cent, of Luunja 32 per cent and of Svea 42 per cent.
Further data from the official trials are given shewing the performance of the new wheat as compared with other varieties in regard to yield of straw, thousand corn weight and protein content of the grain. M. P.

1206. German, E., Cabasson, F. and Fondard, L. 633.11:575.12 633.11:575.243:537.531
Contribution à la génétique des blés de Provence. (**Contribution to the genetics of the wheats of Provence**).
Bull. Off. Agric. Midi 1935 : No. 54 : 81–112 ; No. 56 : 309–54.
An account is given of a series of successive cross-pollinations begun in 1924 with the lax-eared Tuzelle wheats and selections from their progeny, with special reference to the problem presented by a plant No. 200 6, which arose in an improved line Y inbred and was characterized by marked early maturity. The variations observed in the subsequent generations derived from this plant and the unexplained anomaly of a plant with a dense ear which segregated out in F_2 and again segregated for dense and lax ears in the next generation are discussed at some length. Similar phenomena, accompanied by other variations too, were recorded after cross-pollinations in which some of the pollen parents had been treated with X-rays.
The observations are to be continued.

1207. Suneson, C. A. 633.11:575.12:581.036.5
Emasculation of wheat by chilling.
J. Amer. Soc. Agron. 1937 : **29** : 247–49.
Exposure of wheat to temperatures of 27° to 36° F. while the head is enclosed in the leaf sheath causes sterility of the anthers in a proportion of the florets, while the pistil remains fertile. Since the emasculated florets can readily be distinguished from the unaffected ones by the position of the glumes the method has practical applications in hybridization work. A similar reaction occurring in the field may also be a cause of natural cross-pollination.

1208. Saprygina, E. S. 633.11:575.12:581.143.26.03
Yarovization of wheat hybrids of the first generation.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1937 : **XIV** : 457–62.
Crosses were made between spring and winter wheat and a comparison made of the F_1 hybrids, vernalized and unvernalized, grown at different dates and under different conditions of illumination. The later the sowing the slower were the unvernalized hybrids to mature. Vernalization speeded up the process especially when applied to the later sowings.

1209. Luk'janenko, P. P. 633.11:575.127.2
(**Breeding hard winter wheat by the method of interspecific hybridization**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 8 : 28–30.
An abbreviated presentation of the paper reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 943.

1210. 633.11:575.127.2:576.356.2 633.11:575.243:537.531 633.11:576.354.46:575.11
Smith, L. 633.11:576.312.34
Cytogenetic studies in *Triticum monococcum* L. and *T. aegilopoides* Bal.
Res. Bull. Mo. Agric. Exp. Sta. 1936 : No. 248 : Pp. 38.
An extended account of the work reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 827.
Two further mutants in which pairing at meiosis is affected are described. The mutant form

dissociation-*b* resembles the type previously mentioned, dissociation-*a*, in that there is no pairing whatever at first metaphase; but whereas in dissociation-*a* the univalents are split at metaphase I, divide at anaphase I and are distributed at random at the second division, in dissociation-*b* they are undivided and distributed at random at the first division. Dissociation-*b* plants are more fertile than dissociation-*a*. In the third type, dissociation-*c* there is a variable amount of pairing at metaphase I, some of which appears to be between non-homologous chromosomes.
Another mutant type in which the chromosomes are broken up in numerous fragments at first anaphase is briefly mentioned.
A list of viable mutants is given, some of which are of natural origin and others induced by X-ray irradiation. Linkage has been shewn between glume pubescence (*Gs*) and black pigment in the ear (*B*), two characters which have already been reported to be associated in inheritance in 14- and 21-chromosome wheats.
The paper concludes with notes on the morphology of the somatic chromosomes, in which the occurrence of two pairs of satellited chromosomes is mentioned.

1211. 633.11:575.127.5:633.14:576.354.4
633.11:575.127.5:633.289:576.354.4

Kostoff, D.

Chromosome behavior in *Triticum* hybrids and allied genera. II. *Tr. Timopheevi* (n = 14) x *Secale cereale* (n = 7).

Z. Zücht. 1937 : A **21** : 378–79.

Kostoff, D.

Chromosome behavior in *Triticum* hybrids and allied genera. III. *Triticum-Haynaldia* hybrids.

Z. Zücht. 1937 : A **21** : 380–82.

The substance of these two papers has already been reviewed (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 403).

1212. 633.11:575.127.5:633.289
633.11:581.143.26:575

Khižnjak, N. A.

(Form development in *Triticum-Agropyrum* hybrids and the production of perennial wheats).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 12 : 20–33.

The F_1 *Triticum* x *Agropyrum* hybrids shew dominance of most of the *Agropyrum* characters, including the long thermo-stage and photo-stage characteristic of many of the *Agropyrum* forms. Great variation in fertility was observed in the F_1, some clones of certain parental combinations having a quite high degree of self-fertility; this applied to the hybrids of certain Mediterranean forms of *T. durum* with *A. intermedium*, which combination is usually sterile. The fertility of the different clones is not always in proportion to the number of bivalents present.
The sterile hybrid *T. durum* (n = 14) x *A. intermedium* (n = 21), having 35 somatic chromosomes, forms unreduced egg cells with 35 chromosomes and when pollinated with *T. durum* (14 chromosome gametes) gives sesquidiploids with 49 somatic chromosomes, and with *A. intermedium* gives sesquidiploids with 56; when pollinated with *T. vulgare* (n = 21) triple hybrids also with 2n = 56 are formed, and with *A. elongatum* (n = 35) triple hybrids with 2n = 70. The 42 chromosome hybrid *T. vulgare* x *A. intermedium* also forms unreduced egg cells and gives an analogous series of sesquidiploids and triple hybrids. The hybrids with other 28 chromosome wheat species are similar in behaviour to the *T. durum* hybrid, and the hybrids with the 42 chromosome wheats similar to the *T. vulgare* hybrid.
The hybrids of *T. vulgare* with *A. elongatum* contain a larger proportion of self-fertile lines, giving an F_2 in which the chromosome numbers vary from 48 to 62, plants with 54–56 being the most common, and these form 27–28 bivalents at meiosis and are highly fertile.

The sesquidiploids and triple hybrids of *A. intermedium* are, however, of more practical interest, those obtained by pollinating with wheat being much nearer to the wheat type. Awns occurred in some plants of the *T. durum* sesquidiploid, their appearance being ascribed to mutation of the dominant awn inhibitor from *Agropyrum* to the recessive.
The most interesting of all are the *T. vulgare* sesquidiploids, being almost entirely wheat-like in the ear but yet perennial in habit. They have 63 somatic chromosomes and are highly fertile, forming 21–28 bivalents at meiosis, autosyndesis having taken place within the *Agropyrum* chromosomes. Autosyndesis also occurs in the *T. durum* sesquidiploids but to a lesser extent. The triple hybrid (*T. durum* x *A. intermedium*) x *T. vulgare* (2n = 56) has ears and grain of the wheat type, the latter being highly vitreous; the habit is, however, perennial, though less pronouncedly than the *T. durum* series. The number of bivalents varies from 15 to 22. Certain awned plants also occur, their origin being again ascribed to mutation, and occasionally awned sectors appear on an awnless plant.
The sesquidiploids obtained by pollination with *Agropyrum* are much nearer *Agropyrum* in type and are much less fertile than the wheat sesquidiploids, though at meiosis they have no fewer bivalents than the wheat sesquidiploids; their greater sterility is attributed to incompatibility between the chromosomes and the cytoplasm.
Varied segregation occurs in the third generation obtained from the sesquidiploids and the triple hybrids, affecting the chromosome number, morphological and biological characters, all types of ear and grain forms being found, and all degrees of perennity, of resistance to drought and to diseases. The triple hybrids gave a more varied and more fertile progeny than the sesquidiploids, some of the highly fertile lines being perennial. Judging by the relatively small proportions of perennial forms however it would appear that the perennial genes are present in the chromosomes that do not pair with the wheat chromosomes. The combination of wheat characters and perennity is most probable therefore in the sesquidiploids from *T. vulgare* and in the triple hybrids, since they have the greatest number of autosyndetic *Agropyrum* chromosomes. A further promising way of producing them is to pollinate the F_1 hybrids with the wheat sesquidiploids. Thus by pollinating the hybrid *T. durum* x *A. intermedium* (giving unreduced egg cells with 14 *durum* and 21 *Agropyrum* chromosomes) with the sesquidiploid (*T. durum* x *A. intermedium*) x *T. durum* plants were obtained in which the 14 wheat chromosomes of the F_1 conjugated with the 14 wheat chromosomes of the sesquidiploid and all the *n Agropyrum* chromosomes of the sesquidiploid found homologues among the full *Agropyrum* complement of the F_1, leaving a few univalents. These disappear in subsequent generations, leaving chromosomally balanced forms amongst which the desired combination of wheat and *Agropyrum* characters are to be found; e.g. some of the plants obtained in this way are vigorous perennials, highly frost-resistant and resistant to rust, with ears of an almost pure wheat type, large grains, 25–40 per ear, different lines varying greatly in fertility.

1213. Tzitzin, N. V. 633.11:575.127.5:633.289
(Breeding *Triticum-Agropyrum* hybrids).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 10 : 1–4.

Examination of the *Triticum-Agropyrum* hybrids (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 598) shews that the valuable properties of the *Agropyrum* protein, giving it a unique resistance to changes of temperature and especially cold, are transmitted to the hybrids and in some the parental limits are even transgressed. The same is true of the high protein content and quality characteristic of the *Agropyrum*, some of the hybrids in the later generations being much superior to the standard wheat varieties in this respect.
The F_2 plants derived from self-fertile F_1 plants with 28 bivalents vary greatly in fertility, which seems to be influenced by factors other than chromosome pairing. The best way of dealing with sterile forms is found to be to cross them with fertile hybrids, not with the parents. Two constant perennial lines have now been obtained. These are excellent in drought resistance but not so good in hardiness, though hardier selections from them are now being obtained.

1214. Samsonov, M. M. 633.11:575.127.5:633.289:664.641.016
(The quality of the grain of wheat-*Agropyrum* hybrids).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 11 : 35–43.

An investigation of the milling and baking quality of 38 strains from the F_3 of a cross of a soft spring wheat, *lutescens* 062, and *Agropyrum glaucum*. The hybrids were annual in habit. The quality of the parent forms and of *A. elongatum* was also tested.
The grain of the hybrids varied greatly in texture, ranging from very loose and starchy to dense and vitreous.
Analysis shews that *Agropyrum* and wild barley too, as well as wheat, contain gluten, *Agropyrum* having $1\frac{1}{2}$ times as much gluten as the wheats *Caesium* 0111 and *hordeiforme* 010. The quality of the *Agropyrum* gluten was excellent and *Agropyrum* flour produced a loaf of normal quality as compared with a wheaten loaf.
The loaf from the hybrids was of excellent baking quality and these preliminary investigations suggest that new hybrids of the type in question may possibly replace old standard varieties such as *Caesium* 0111.
High yield can be combined with high baking quality. A biochemical and technical examination should precede the selection of parent forms in the production of wheat x *Agropyrum* hybrids.

1215. Stefanovskii, I. A. 633.11:581.143.26:575
(Inheritance of vegetative period in spring wheats grown under different conditions).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 11 : 44–50.

F_1 and F_2 hybrids derived from inter- and intra-specific crosses between a number of spring wheats which differed in drought resistance and, to some extent, in length of vegetative period were tested under conditions varying as regards time of sowing and soil moisture.
The F_1 under ordinary field conditions without irrigation tended, as regards ripening time, to resemble the early parent and did not exceed the range of the two parents. Under conditions of irrigation, however, a tendency to slower vegetative development was noted as compared with the previous group, though there was on the whole a greater tendency to earliness than lateness. One cross gave an intermediate F_1. A more or less similar behaviour was observed in F_2 under conditions of irrigation.
Late sowing—40 days later than normal—resulted in the F_1 in very marked earliness (i.e. short vegetative period) and forms earlier than the early parent were observed. So that here there was more marked dominance of earliness in the F_1 as compared with other environmental conditions; in the F_2 this dominance was still more marked though forms with a long vegetation period were also noted.

1216. Caron-Eldingen, v. 633.11:581.6
Die Aufgabe des Weizenzüchters zur Verbesserung des Weizenbrot-Aromas. **(The problem of the wheat breeder in improving the flavour of wheaten bread).**
Mehl u. Brot, Berlin 1936 : **36** : Nr. 34 : 1–2.

The variety of wheat is most important with regard to the flavour of the bread and breeding to increase the amount of "diacetyl" in the flour should be undertaken.
A thinner bran layer is also a desirable objective.

1217. Caron-Eldingen, v. 633.11:581.6
Weizenzüchtung und Weizenbrotgeschmack. **(Wheat breeding and the taste of wheaten bread).**
Mehl u. Brot, Berlin 1936 : **36** : Nr. 31 : 1–3.

The author makes various suggestions for increasing the consumption of bread by improvement in the taste which has been much neglected by breeders. A mixture of spring and winter

wheats is a necessary preliminary to a good-tasting bread. Special attention should be paid to the good quality B-wheats which are apt to be neglected for the best quality A-wheats. Thinness of bran layer should be considered in breeding and more attention should be paid during the baking process to the production of a bread of agreeable flavour.

1218. 633.11–2.111–1.521.6:575(44)
CRÉPIN, CH. 633.11 Côte d'Or
Création de variétés de blé résistantes au froid. (**The creation of varieties of wheat resistant to cold**).
C.R. Acad. Agric. Fr. 1937 : **23** : 440–47 ; also Agric. Prat. Paris 1937 : **101**: 661–63.
The production of varieties of wheat resistant to cold by means of crosses with hardy varieties of other countries is briefly described. One result of such work, Côte d'Or, an early wheat very resistant to cold, lodging and yellow rust is to be put on the market in the autumn of 1937.

1219. BAYLES, B. B., TAYLOR, J. W. and BARTEL, A. T. 633.11–2.112–1.521.6:578.081
Rate of water loss in wheat varieties and resistance to artificial drouth.
J. Amer. Soc. Agron. 1937 : **29** : 40–52.
The rate of loss of water of cut shoots of eight wheat varieties shewed substantial agreement with their drought resistance. The results were most consistent when the material was grown in soil of optimum moisture content.

1220. BRYAN, W. E. 633.11–2.451.3–1.521.6:575.11
Breeding for smut resistance in Arizona-grown wheat.
Tech. Bull. Ariz. Agric. Exp. Sta. 1937 : No. 66 : 95–123.
Although bunt or stinking smut (*Tilletia tritici* and *T. levis*) can be controlled by seed treatment, the amount of smutted wheat arriving at the mills indicates that a resistant wheat is required in Arizona and breeding work was therefore started on this problem.
The susceptible parents used were Sonora, Escondido, Pusa and Baart, white spring wheats, of which Sonora and Baart are regarded as completely susceptible. The resistant varieties were Hope, a spring wheat and Ridit and Hussar, winter wheats; Ridit and Hussar have shewn no infection in tests in 1932, '33 and '34 while Hope gave an average of 6·7 per cent smutted plants.
The F_1 and F_2 progenies were grown under smut-free conditions and the segregation in F_2 was tested by observing the behaviour of the F_3 progenies, the seed from the F_2 plants being inoculated with spores from a collection identified as *T. tritici* (strain T1). Importance is placed on soil temperature at the time of germination and it is believed that in some years less than the maximum infection was obtained owing to the soil temperature being too high. The range in percentage infection in the hybrid progenies was very great, from 0 to nearly 100 in all crosses. In the crosses involving Ridit and Hussar there was a marked maximum in the classes 0 and 0–10 per cent, while in the crosses involving Hope there was no marked maximum. It is suggested therefore that the resistance of Hope is due to multiple factors while that of Ridit and Hussar is based on a small number of main factors operating with dominance. Tests in later generations have shewn that making an arbitrary division into resistant and susceptible classes on the basis of percentage infection in F_3 tests is unreliable and on account of this and of the variation in infection from year to year it is not possible to say how many main factors are involved. The results in later generations have also indicated the presence of modifying factors.
From the breeding point of view Ridit and Hussar are to be regarded as better able to transmit their resistance than Hope. Certain resistant selections from Ridit crosses have given yields very nearly equal to that of a strain of Baart, which is usually considered the standard variety for Arizona.

1221. 633.11–2.452–1.521.6:575(47)
LUK'JANENKO, P. P. 633.11–2.451–1.521.6:575(47)
(Breeding rust resistant varieties of winter wheat).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : 31–33.

From crosses of the Canadian spring wheats Marquis and Kitchener with the Russian local forms *Ferrugineum* 013 and *Introaristatum* 0265 the six varieties here described, H-51, H-622, H-622/2, H-43, H-56 and H-49 were obtained. They are characterized by high resistance to brown rust and some (e.g. H-51 and H-49) are also resistant to stem rust. H-51 is furthermore declared to be resistant to *Tilletia* and not very susceptible to *Ustilago*.
All the new varieties are superior in yield to the standard varieties Ukrainka and Stavropol'ka 0328 and H-622/2 has surpassed the former by 50 per cent and the latter by about 20 per cent, while H-51 gave a yield of 33·21 centners per hectare in 1936 as compared with 23 centners for Ukrainka and 30 centners for Stavropol'ka. Yield trials on a commercial scale have been planned for 1937.
The quality of the grain of new varieties is also high, as is also for the most part their baking quality. Finally it is claimed that the new forms are superior as regards shattering and resistance to lodging.

1222. 633.11–2.452–1.521.6:575(47)
LUK'JANENKO, P. P. 633.11–2.451–1.521.6:575(47)
(Results of work on breeding rust resistant varieties of winter wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 11 : 51–55.

Six new varieties produced from material originally obtained by crosses of Canadian spring varieties with winter forms obtained from Russian local wheats are being officially tested. Several are resistant to brown rust and some also to stem rust. H-51 is also resistant to wet rot and only mildly susceptible to *Ustilago*. H-46 and 49 are resistant to brown rust and to stem rust; while H-43 is rather severely infected by stem rust. The performance of a number of other hybrids is recorded and *inter alia* the new form *Caesium* 1/36 (derived from line No. 622/2), is stated to be resistant to both brown and stem rust.
Data are presented shewing that all the new rust resistant varieties have given higher yields than Ukrainka and Stavropol'ka 0328 which are standard forms. H-51 is also highly rated as regards physical and chemical properties of the seed; and it has a particularly high hectolitre weight, very large grains and a very high percentage of protein. It is also early ripening.
The baking quality of the new varieties was also superior to that of the standards—except H-43 and H-46.
The new productions also shew valuable features as regards resistance to lodging and to shedding.

1223. SIBILIA, C. 633.11–2.452–1.521.6:575:551.563
L'influenza della altitudine sulla preseunta resistenza dei grani alle ruggini.
(The influence of the altitude on the presumed resistance of wheats to rusts).
Boll. Staz. Patol. Veg. Roma 1936 : **16** : (N.S.) : 271–77.

The work, mainly carried out in Kenya, on the effect of altitude on rust resistance in wheat is reviewed with some fullness as it has a special significance for Italy to-day.
Resistance to rust is not necessarily related to cultivation at high altitudes; and it is possible, by hybridization to produce strains resistant to most of the races of *Puccinia graminis*.

1224. Suchorukov, K. T. and Ovčarov, K. E. 633.11–2.452–1.521.6:581.192:575

On the nature of immunity to rust.

C.R. (Doklady) Acad. Sci. U.R.S.S. 1937 : **XIV** : 393–96.

A comparison of the ammonia content of species of wheat led to the conclusion that immunity to rust is produced by a high ammonia content. Ammonia content is stated to be an inheritable character, modified by the environment. The determination of the ammonia content is suggested as an indirect method for determining the degree of resistance to rust.
The behaviour of urea and urease was also investigated.

1225. Česnokov, P. G. 633.11–2.7–1.521.6:575.42

(Resistance of spring wheats to the frit fly).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 2 : 36–37.

Data are cited to shew that among wheats from various countries (including the U.S.S.R.) differences exist in susceptibility to *Oscinis frit* L. and that hence the isolation of resistant forms by selection should be possible. The estimation of susceptibility should be made during the early periods of plant development, when the varietal differences as regards injury are most marked. Breeding for a harder stem and a reduction of the excessive tillering frequently accompanying susceptibility is recommended.

1226. Fifield, C. C. and Clark, J. A. 633.11:664.641.016

Milling and baking experiments with hard red spring wheats, 1929-1935.

Bur. Pl. Ind., U.S. Dep. Agric. Wash. 1936 : June 15 : Pp.28.

The results of tests of the baking quality of nine "uniform" varieties are tabulated. In addition, tests were made on other varieties and hybrid strains in comparison with Marquis. Tests made on some promising new hybrid strains are also recorded.

1227. Miège, E. 633.11:664.641.016(64)

Nouveaux essais sur la valeur boulangère des blés (récolte 1935). Comparaison des méthodes d'évaluation et influence des divers facteurs. (**New studies on the baking quality of wheat, 1935 harvest. A comparison of methods of evaluation and the influence of various factors**).

Rabat 1936 : Pp. 83.

After a review of views of various workers on the problem of the determination of baking quality the results for the wheat harvested in Morocco in 1935 are considered.
In spite of the effect of external conditions on quality there was a definite improvement as compared with the year before (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 859).

1228. 633.11:664.641.016(65)
633.16:663.421(65)

Contribution à l'étude de la valeur industrielle des blés et de quelques orges d'Algérie de la récolte 1935. (**A contribution to the study of the industrial value of the wheats and of some barleys of Algeria of the 1935 harvest**).

Exp. Agric. Direct. Serv. Econ. Algérie 1936 : Cereales No. 2 : Pp. 44.

A discussion of the properties of wheat which are of industrial value—a wider term than baking value. Tables are given shewing for each variety the humidity, hectolitre weight, thousand corn weight, texture of the grain, humidity of the flour, gluten qualities, colour of the flour and extensimeter and farinograph readings and other data.
There is a brief note on the value for brewing of the Algerian barleys.

1229. MANGELSDORF, P. C. 633.11:664.641.016(76.4)
Wheat quality in the southwest as viewed by the agronomist.
Cereal Chem. 1937 : **14** : 97–103.
Factors other than merely baking value are the concern of the grower of high quality wheat. The most important, drought, winter-killing, disease resistance and earliness are briefly reviewed.

1230. ALABOUVETTE, L. 633.11:664.641.016:575.11
Contribution à l'étude du caractère "force" du blé. (**Contribution to the study of the character "strength" in wheat**).
C.R. Acad. Agric. Fr. 1937 : **23** : 379–83.
An F_4 hybrid of two weak wheats, Ardito, W = 150 and Soleil, W = 100, was crossed with the strong wheat Providence, W = 300, and the "strength" of the progeny measured by means of Chopin's extensimeter. The measurements were first made on the F_4, on an unselected population and on the progeny of a certain number of plants grown from one ear of each F_2 family. In the F_3 the majority of the plants were eliminated on account of susceptibility to lodging or other defects.
The unselected plants shewed an average value intermediate between that of the parents. Some of the families were superior in value to the best parent. No correlation could be found between strength and any other hereditary character. With two exceptions, the families with W less than that of the unselected plants had relatively "weak" progeny and those families with W equal to or greater than Providence remained "strong".
The number of plants was too small to determine the number of factors involved in the inheritance of strength.

1231. CUTLER, G. H. and
WORZELLA, W. W. 633.11:664.641.016:578.081
The wheat meal fermentation time test with special reference to its reliability as a measure of quality in soft winter wheats.
J. Amer. Soc. Agron. 1937 : **29** : 220–26.
Data are presented to shew that the fermentation time test compares favourably with protein content and baking tests when applied to soft or semi-hard winter wheats. The fermentation time test not only gave consistent results from year to year at all locations but was capable of estimating smaller differences than the other two methods.

1232. 633.11.00.14:551.566.3(98)
FLAKSBERGER, C. A. and 581.143.26.03:633.11
SMIRNOVA, M. I. 633.11:575(98)
(**Wheats beyond the Arctic Circle**).
Bull. Appl. Bot. Leningrad 1936 : Ser. XV (5) : 3–38.
The results obtained in wheat tests at the Khibiny Station have been examined in order to find the most suitable types for Khibiny and for sub-arctic regions in general. Early forms are essential and must be obtained by breeding. It is suggested that some early form of northern wheats should be crossed with some form from among the wheats of Afghanistan, India, Japan, China or South America that has proved able to stand low temperatures from earing to maturation. Another possibility would be a cross between an early northern type and a wheat in which vernalization accelerates both earing and ripening.
Work on vernalization should be continued. Certain wheats from Bulgaria, Jugoslavia, Italy and Transcaucasia have already given interesting results with vernalization and might provide material for profitable crosses with early northern varieties of the U.S.S.R.

1233. Taborda de Morais, A. 633.13(46.9)
Estudos nas aveias. I. As aveias Portuguesas da secção *Euavena* Griseb. **(Studies on oats. I. The Portuguese oats of the section *Euavena* Griseb.).**
Bol. Soc. Broteriana 1936 : **11** : II Sér. 49–86.

The species described are *A. sterilis* and its varieties *maxima, scabruiscula* and *calvescens*; *A. fatua* and its varieties *pilosissima, glabrata* and *intermedia*; *A. byzantina*; *A. sativa*; the hybrids of *A. fatua* x *sativa*; *A. fatua* x *sterilis* and of *A. sativa* x *sterilis*.
A. sterilis var. *calvescens* and the hybrids of *A. fatua* x *sativa* are noted for the first time in Portugal.
Mention is made of natural hybrids of *A. sativa* x *A. sterilis* and of *A. byzantina* x *A. sterilis*.
A. Ludoviciana has been established as a hybrid of *A. fatua* x *A. sterilis*.
A. fatua has been observed in quantity and the phenotypic equivalence of fatuoids with *A. fatua* var. *glabrata* and of steriloids with *A. sterilis* var. *calvescens* has been verified.

1234. Coffman, F. A. and Stevens, H. 633.13:575.12
Influence of certain oat varieties on their F_1 progeny.
J. Amer. Soc. Agron. 1937 : **29** : 314–23.

Data are given to shew the influence of the varieties Markton, Black Mesdag, Nortex, Richland, Victoria and Bond on their F_1 hybrids in respect of height of plant, number of tillers and yield of grain.

1235. Misonoo, G. 633.13:581.162.036
Ecological and physiological studies on the blooming of oat flowers.
J. Fac. Agric. Hokkaido Univ. 1936 : **37** : 211–337.

The extensive studies here presented indicate that blooming is caused by a fall in temperature from a maximum and that blooming can be controlled by artificially adjusting the temperature.

1236. Coffman, F. A. 633.13–2.111–1.521.6:575.127.2
Species hybridization, a probable method for producing hardier winter oats.
J. Amer. Soc. Agron. 1937 : **29** : 79–81.

In co-operative winter-hardiness tests of oats in the U.S.A., several varieties have proved more hardy than Turf (Grey Winter). All such varieties, Hairy Culberson, Bicknell, Culberson, Fulghum (winter type) Custis and Tech, trace their ancestry back to Red Rustproof or some similar *Avena byzantina* variety and yet have characters suggestive of *A. sativa*. It is suggested therefore that they owe their origin to natural hybridization between these two species.
Support for this hypothesis is obtained from segregates of the cross Markton x Red Rustproof. Markton is a spring oat belonging to *A. sativa* and Red Rustproof is not very hardy, yet two segregates from this cross are apparently hardier than the best Red Rustproof strains.

1237. Humphrey, H. B. and
Coffman, F. A. 633.13–2.45–1.521.6:575.12
A study of the reaction of F_1 oat hybrids and their respective parental lines to inoculation with smuts and rusts.
Phytopathology 1937 : **27** : 183–89.

The reaction of the F_1 hybrids of a large number of intervarietal oat crosses was tested for resistance to stem rust, *Puccinia graminis avenae* Eriks. and Henn. or to crown rust, *P. coronata avenae* F. and L. or to the smuts *Ustilago levis* and *U. avenae*.
Because of the value and scarcity of the seed, the seed of the F_1 hybrids was not hulled before inoculation with smut as was that of the parents. Although in several crosses one of the parents was susceptible to smut all the hybrids proved resistant.
Resistance to stem rust was also dominant in the majority of the F_1 hybrids regardless of the reaction of the parents.
The tests of the resistance to crown rust were carried out on the same plants inoculated with stem rust. Although resistance was either dominant or intermediate the dominance was not as pronounced as in the previous case.

1238. KOSTOFF, D. 633.14:575.127.2:576.354.4

Interspecific hybrids in *Secale* (Rye) I. *Secale cereale* x *Secale ancestrale*, *S. cereale* x *S. Vavilovii*, *S. cereale* x *S. montanum* and *S. ancestrale* x *S. Vavilovii* hybrids.

C.R. (Doklady) Acad. Sci. U.R.S.S. 1937 : **XIV** : 213–14.

All the F_1 hybrids had the brittle spikes of the wild species. All, except the F_1 hybrids of *S. cereale* x *S. montanum*, were highly fertile. The pollen shewed a high percentage of viability in all the hybrids.

The haploid chromosome number of all the species used was 7. The F_1 hybrids of *S. cereale* x *S. montanum* had 5–7 bivalents, all the other hybrids had usually 7 bivalents. The occurrence of one or more chiasmata per bivalent indicated that crossing-over occurred between the parental chromosomes and the formation of 7 bivalents indicates the homology of the genom of *S. cereale* with those of the wild species.

Only slight irregularities were observed in the meiotic divisions of the hybrids. Most of the plants obtained from selfing *S. cereale* x *S. montanum* and especially from the back-cross with *S. cereale* were more fertile than the F_1 hybrids.

Heteroploid plants with 15 somatic chromosomes were observed and probably originated by the fusion of a normal gamete with one with 8 chromosomes. One plant with 23 somatic chromosomes was observed.

The value of *S. ancestrale*, a productive and robust species, as breeding material is pointed out.

1239. NILSSON, H. 633.14:575.14:575.182

Eine Prüfung der Wege und Theorien der Inzucht. (**A test of methods and theories of inbreeding**).

Hereditas, Lund. 1937 : **23** : 236–56.

An account of the methods of inbreeding used by the author on rye in an effort to find a method which would allow of the maximum genetic differentiation without a depression in vigour. In general the methods consisted in applying some degree of inbreeding, followed by crossing to restore vigour. Vigour was estimated by the yield in the F_2 or later generations after crossing.

In the first method, designated IK, inbreeding was performed by enforced self-pollination. On crossing inbred lines a stimulation in F_1 was noticed but in F_2 the average yield was only 76 per cent of the standard or original variety. Thus although this method is the best for differentiating lines it is useless in practice because of the reduced yields.

The next method, designated PK, consisted in crossing pairs of plants, selected for desired characters, by enclosing their ears in the same bag. Here again in the F_2 a marked depression in yield was encountered, 85 per cent of the standard being obtained. Similarly, in crosses of individual plants from different varieties a depression in yield of the same order was obtained, leading to the conclusion that practical results are not to be obtained with rye by the use of crosses between individual plants.

The next method used, designated EL, consisted in the development of élite lines by selecting élite plants and growing the progeny obtained from them by open pollination. Here an average depression in yield of 10 per cent was found. When, however, élite lines were crossed by mixing the seeds before sowing, the F_4 yield was on the average about equal to that of the standard and by this method (called EK) lines were obtained which surpassed the standard by as much as 10 per cent. The yields were tested in the F_4 because it was considered that the crossing was not sufficiently complete until the third generation. Another method of crossing the élite lines is designated GK and consists in growing them in rows next to each other, but here the lines are harvested separately. The average yield was about the same as in the EK method.

The author lays great importance on his method of isolation. Unwanted pollen was excluded by growing the breeding lines in a wheat growing district and widely separated from each other.

His practical results were confirmed by more careful experiments with what he terms rational depression series in which the PK, EL and EK methods were carried out using the same plant as starting material, by using different ears of a well-tillered plant. He is led to the conclusion that the characteristic depression in yield is a consequence neither of gene recombination nor of the degree of heterozygosity, but follows rather the plasmatic effect of the parents on the progeny. Thus the more diverse the origin of the plasma in the progeny the less the depression in yield. In the EK there are two female plasmas and two whole groups of male plasmas and it is here that the depression disappears. The GK lines shew that a great diversity in male plasmas can remove depression even when there is only one female plasma concerned. The author considers that in addition to this factor ("homoplasmony"), the homozygous condition as such, and also genetic factors of the lethal type cause depression.

1240. 633.14:575.24:576.356.5:537.531
635.656:575.24:576.356.5:537.531

Breslavets, L. P.

(The action of X-rays on seeds).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 7 : 32–34.

Records similar data to those reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 1240. A stimulatory after-effect was observed also in the second year of the experiment when the yield of the rye plants raised from the first year group was 30 per cent higher than that of the progeny of the controls, though not equal to the first year standard. A similar increase was obtained with peas, a dosage of 350 r being especially effective in increasing the weight of the peas.

The good results were attributed to an increase in the nuclear substance due to the formation of bi-nuclear or polyploid cells and to an increased rate of cell division. The highest division rate was found in rye after treatment with 750 r (which also produced the highest yield) and two root tips entirely hexaploid, i.e. with 42 instead of 14 chromosomes were found after such treatment. The cytological findings for peas bore out these results.

MAIZE 633.15

1241. 633.15:575(47)

Sokolov, B. P.

(Results of work on maize breeding).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : p. 18.

Maize selections maturing 20–30 days before the standard, others excelling the standard in yield and high-yielding hybrids between inbred lines have been produced.

1242. 633.15:575.11.061.634:576.356.2

Creighton, H. B.

White seedlings due to homozygosity of a deficiency in chromosome IX of *Zea mays*.

Genetics 1937 : **22** : 189–90. (Abst.)

Evidence is presented to shew that white seedlings occurring in progenies of self-pollinated individuals heterozygous for a deficiency in the short arm of chromosome IX are actually plants homozygous for the deficiency. The white plants are as vigorous as normal seedlings for the first 7 to 10 days of growth. Cell development in the grain is apparently normal and both male and female deficient gametes and gametophytes must have functioned to produce such plants. The disturbance of the chlorophyll mechanism may therefore be the only cellular disorder produced by the deficiency, though attempts to prolong the growth of white plants in nutrient culture media have not succeeded.

It is suggested that other albino characters, attributed to recessive genes such as w_1, w_2, etc., may actually be produced by homozygous deficiencies.

1243. Haber, E. S. 633.15:575.12:578.08
Hybrid sweet corn seed production by the canner.
Canner 1936 : **82** : No. 4 : 24–25, 34.

Haber, E. S.
Hybrid sweet corn for the canner.
Canner 1936 : **82** : No. 6 : 14–15, 24.
The first of these two articles contains practical directions for the production of top crosses and for hand pollination to maintain inbred lines, with remarks on the relative value of this method of seed production as compared with single, three-way and double crosses which are described in the second article. Attention is also drawn to the disease resistance of such hybrids as compared with open pollinated strains.

1244. Singleton, W. R. 633.15:575.12:578.08
The crossing plot for increasing inbred corn seed.
J. Amer. Soc. Agron. 1937 : **29** : 81–83.
A modification in the method of increasing inbred lines of maize is proposed with the object of reducing the possibility of contamination without greatly increasing labour. Hand pollinated seed is used for growing male rows, the other rows being detasselled and so the increase plot is grown as a crossing plot.

1245. Sprague, G. F. 633.15:575.125
Hybrid vigor and growth rates in a maize cross and its reciprocal.
J. Agric. Res. 1936 : **53** : 819–30.
Ashby's experiments on hybrid vigour in maize (Cf. "Plant Breeding Abstracts", Vol. I, Abst. 12 and Vol. III, Abst. 148) were repeated using later generations of the same inbred lines and their reciprocal F_1 hybrids. The results agree substantially with Ashby's inasmuch as significant differences in growth rate were not established for the period from the late seedling stage to maturity, but it is considered that this was due to the great variability of the material rather than to the absence of such differences.
A difference from Ashby's results was that no consistent differences in reciprocal crosses due to different embryo weights was found. Such a difference persisted for a time but disappeared before the completion of maturity. Again, one hybrid had a smaller grain and embryo weight than its maternal inbred line yet weighed more than twice as much as the parent at maturity. By harvesting hybrid seed of one cross at different stages of maturity seeds were obtained with different embryo weights, but this difference was ineffective in modifying hybrid vigour. It is concluded that hybrid vigour cannot be attributed to the maintenance of an initial difference in embryo size.

1246. Weatherwax, P. 633.15:576.1
The origin of the maize plant and maize agriculture in ancient America.
Univ. N. Mex. Bull. 1936 : No. 296 : 11–18.
The substance of this paper is contained in the article reviewed in "Plant Breeding Abstracts", Vol. V, Abst. 1005.

1247. Kempton, J. H. 633.15:576.1:581.9
Maize as a measure of Indian skill.
Univ. N. Mex. Bull. 1936 : No. 296 : 19–28.
The author discusses the origin and spread of maize. He concludes that the most likely centre of origin is northwest Guatemala. He surveys the different theories which have been advanced to solve the problem of the parent of maize as it is now known, with the objections which can be raised against them. Whatever its origin there is no doubt that maize has been greatly modified by a long process of selection by the Indians.
Maize came into the southwestern United States from Mexico and the earliest centre of maize culture in the U.S.A. was probably in the region of the junction of the states of Arizona, New

Mexico, Utah and Colorado. It is here that the greatest concentration of varieties is now found. Of the Indian tribes of the U.S.A. the Navajos have by far the largest number of varieties, though the Hopi and Zuñi have sorts not grown by the Navajos and the Papagos are the only tribe of the region from which pop and sweet varieties have been obtained.

1248. McClintock, B. 633.15:576.356.2
The production of maize plants mosaic for homozygous deficiencies : simulation of the bm_1 phenotype through loss of the Bm_1 locus.
Genetics 1937 : **22** : p. 200. (Abst.)
Losses or changes in size of ring chromosome fragments produced by X-ray treatment give rise to patches of tissue homozygous for deficiencies of varying extent, some of which produce phenotypic effects like those of the gene bm_1, whose locus is involved in the deficiency.

1249. Sass, J. E. 633.15:576.356.5:581.192.6
Histological and cytological studies of ethyl mercury phosphate poisoning in corn seedlings.
Phytopathology 1937 : **27** : 95–99.
The occurrence of polyploid cells in the hypertrophied organs of corn seedlings treated with ethyl mercury phosphate is noted.

1250. Weiss, M. G. and Wentz, J. B. 633.15:581.149:575.11.061.6
Effect of luteus genes on longevity of seed in maize.
J. Amer. Soc. Agron. 1937 : **29** : 63–75.
It is shewn that the genes *luteus*$_2$ and *luteus*$_4$ cause a decrease in the longevity of maize seed when present in the homozygous condition, producing deficiencies in *luteus* seedlings when segregating progenies are grown from aged seeds. The extent of the deficiency was different in different progenies.
No decrease in viability was detected in seeds homozygous for *luteus*$_1$, *luteus*$_5$, *luteus*$_6$ or *luteus*$_8$.
Aged seeds homozygous for *luteus*$_2$ or *luteus*$_4$ also gave slower germination and after germination grew more slowly than normal seedlings.

1251. Zapparoli, T. V. 633.15–2.112:575
Osservazioni tecniche sul miglioramento di razza e sulla difesa contro la siccità nella coltivazione del granoturco. (**Technical observations on the improvement of the race and on the defence against drought in the cultivation of maize**).
Ital. Agric. 1937 : **74** : 67–78.
A brief outline is given of the methods of crossing and of mass selection in maize improvement. A number of new varieties recently put, or nearly ready to be put on the market by the "Stazione Sperimentale di Maiscoltura" are reported.
Directions on the best methods of cultivation to minimize the effect of drought are briefly given. The choice of early and short varieties is advocated.

1252. Ivanoff, S. S. 633.15–2.3–1.521.6
Resistance to bacterial wilt of open-pollinated varieties of sweet, dent, and flint corn.
J. Agric. Res. 1936 : **53** : 917–26.
Resistance to bacterial wilt (*Phytomonas Stewarti*) was studied in varieties of sweet, dent and flint corn. Considerable differences in resistance were found within each of the three varietal groups.
Correlations were found between resistance and height, resistance and lateness and height and lateness in each group.

1253. Ivanoff, S. S. and Riker, A. J. 633.15–2.3–1.521.6:575.11
Resistance to bacterial wilt of inbred strains and crosses of sweet corn.
J. Agric. Res. 1936 : **53** : 927–54.

The resistance to bacterial wilt (*Phytomonas Stewarti*) of a large number of inbred strains and of F_1 hybrids and top crosses of maize of the Golden Bantam type shewed great variations. Correlations between resistance and height and earliness were confirmed (Cf. Abst. 1252) but there was also a type of resistance that was correlated with neither of these characters. Evidence is presented for regarding the resistance of the hybrids as in the main dominant. The resistance of hybrids from highly resistant inbred strains was not definitely correlated with height and lateness and these hybrids are regarded as the most promising material for the selection of early resistant strains for industrial needs.

BARLEY 633.16

1254. Honecker, L. 633.16:575(43)
Die Stellung der Gerste in der Erzeugungsschlacht mit besonderer Berücksichtigung der Braugerste. (**The position of barley in the struggle for production, with special reference to brewing barley**).
Prakt. Bl. Pflanzenb. 1937 : **14** : 325–42.

Inter alia the author considers the barley breeding problems raised by Germany's struggle for self-sufficiency in nutrition.

Since much more barley is grown for brewing than is used for that purpose the devotion of a larger area to the growing of fodder barleys offers a means of reducing the deficiency in proteins in Germany. From a breeding point of view, however, the possibilities of increasing protein content are limited. The variability in this character from year to year is much greater than from strain to strain. Certain Japanese strains were found to give a high percentage of protein, but their yield was very low and it was found that their high protein content was not an inherited character but was due rather to their susceptibility to *Puccinia simplex*. An increase in protein content as a result of adverse factors is common in barley.

An absolute increase in protein can be obtained by an increase in yield. An objective which has been neglected in the past is the breeding of disease-resistant fodder varieties very resistant to lodging, which can respond to increase manuring by an increase in yield and to a certain extent in protein content, without lodging. Work has already begun in this direction and in two or three years short-strawed six-rowed fodder barleys will appear on the market capable of giving considerable increases in raw protein per acre.

Of general importance in barley is the breeding of disease-resistant forms, the most important diseases being mildew and *P. simplex*.

Work on resistance to mildew has been in progress at Weihenstephan for many years and the presence of nine physiological forms of the parasite has been established. Only one of these is responsible for most of the outbreaks of the disease in Germany. This year a new variety of brewing barley resistant to the most important biotypes of mildew, bred at Weihenstephan, will appear on the National Variety List. This variety has surpassed the next best older varieties in yield by 15 per cent. In consequence of its freedom from mildew it tends to have a lower protein content. It has rather high requirements in cultivation and manuring and is suited therefore to the best barley districts. Other resistant varieties of the Isaria type are being bred for other districts.

Similar work is in progress with respect to *P. simplex*. Among the difficulties occurring in breeding brewing barleys is the lack of a small-scale test for brewing qualities.

Another important aim in brewing barley is resistance to lodging. Length of straw is an important component of this character, but there is an unfortunate correlation between length of straw and form of grain, an increasing tendency to form badly shaped grains as the length of straw diminishes. A similar connexion exists between certain stem tissues and the character of the glumes, the stronger these stem tissues, the harsher the glumes. This might be avoided by the use of naked barleys, but brewing tests with these have yielded very disappointing results. They may, however, be of use as fodder barleys, provided better yielding strains can be bred, for in consequence of the absence of the glumes their protein content is relatively

high. The non-lodging brewing varieties available at present are long-strawed and owe their resistance to lodging to their slow early development, which allows the lower part of the stem to strengthen.
The article concludes with a few remarks on the restriction in the number of varieties in Germany. Of 183 spring barley varieties on the market before 1934, only 10 are now registered for the whole country and 20 conditionally for certain areas.

1255. Robertson, D. W. 633.16:575.182.061.6
Maternal inheritance in barley.
Genetics 1937 : **22** : 104–13.
The character chlorina, a pale green, chlorophyll deficient plant colour found in a plant of Coast barley, shews maternal inheritance. It has remained constant in pedigree culture and has not been changed by three generations of back-crossing to plants of normal green colour, using the latter as male parents.
Inoculation studies indicated that it is not due to a virus and the chromosome number in chlorina plants was the normal $2n = 14$.
Reciprocal crosses made to study the segregation of factors belonging to the seven different linkage groups in chlorina and normal green families shewed that their segregation was not affected.

1256. Popova, P. A. 633.16:581.143.26.03:575.12
(**Application of the theory of T. D. Lysenko to barley breeding**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 9 : 30–31.
The hardiness of a barley variety can be judged by the amount of development of the growing point in the autumn when autumn sown, the hardiest varieties shewing no development of the growing point at all. In spring barleys, even if they complete the thermo-stage of development, the further growth of the growing point is prevented by the absence of suitable light conditions. The hardiest forms of all will obviously be those combining the long thermo-stage of the winter barleys with this spring characteristic in the photo-stage and hybridization of these two types is being carried out now in the hope of producing segregates more hardy than either parent.

1257. Kuckuck, H. 633.16–2.111-1.521.6:575
Züchterische Versuche mit Wintergerste. (**Breeding experiments with winter barley**).
Z. Zücht. 1937 : A **21** : 271–76.
A survey of the author's breeding work with winter barley at Müncheberg since 1928. The chief aim was the production of winter-hardy forms suitable for eastern Germany, in particular East Prussia; other qualities desired were yield, resistance to lodging and early maturity. The breeding of naked barleys and mildew-resistant forms is to be described elsewhere.
The material available at the beginning of the work contained odd strains (F_6–F_8) from crosses made by E. Schiemann in a study of the genetics of winter and spring habit in barley, including some crosses between winter and spring barleys. Élite plants were selected and their progeny tested for winter-hardiness by comparison with a standard variety at Müncheberg and at other places with more severe winters and also by artificial freezing experiments. Yields were tested in later generations. Two strains, 4210 and 4217 gave a yield 10·3 per cent higher than the standard and were better in respect of lodging, but no strains were sufficiently winter-hardy. It had been hoped to obtain winter-hardy forms by transgression, but no marked transgression occurred either in the crosses winter x winter barleys or in winter x spring barleys.

With a view to obtaining transgression in winter-hardiness by crosses between geographically distant forms, Rumanian barleys were investigated. Different land varieties were obtained and in 1932 élite plants were selected. In 1932–33 the progenies of 469 élite plants were tested for hardiness with Peragis as standard. It was found that 298 were below, 101 above and 70 about equal to the standard, shewing that the varieties were very heterogeneous in this respect. In the following year 116 strains were tested and while the standard was markedly injured, about half the strains were graded as good or fairly good. In 1934–35 42 strains were tested, but in this year the story was entirely different, for while Peragis shewed hardly any injury, most of the strains were more or less badly injured and only six equalled the standard. In connexion with this different behaviour in different years three points are mentioned: firstly, that the Rumanian varieties are capable of flowering with spring sowing and are alternative rather than winter forms; secondly, that in tests of frost resistance most of them are not very resistant; and thirdly, that they begin their development very late in the spring and it is to this that they owe their escape in 1932–33 and 1933–34, when Peragis was injured by late spring frosts. Their physiological behaviour has been further investigated by Hoffmann (Cf. Abst. 1258). While it does not appear possible to obtain useful forms by selection from these Rumanian varieties, their peculiar behaviour does suggest the possibility of using them in breeding for transgression. Crosses were made in 1933 between Peragis and some of the hardier strains and in 1934–35 certain of the F_2 generations shewed good winter-hardiness in comparison with the standard. (Cf. also "Plant Breeding Abstracts", Vol. VI, Abst. 555).

1258. Hoffmann, W. 633.16–2.111–1.521.6:581.143.26.03:575
Physiologische Untersuchungen an Gersten und Betrachtungen über Winterfestigkeit in Hinblick auf die Züchtung winterfester Gerstenformen. (**Physiological investigations on barley and considerations on winter-hardiness with regard to the breeding of winter-hardy forms of barley**).
Z. Zücht. 1937 : A **21** : 277–93.

An investigation of the physiology of the Rumanian barleys mentioned in Abst. 1257, in comparison with winter and spring barleys.

Vernalized and non-vernalized sowings of the three types were subjected to continuous illumination in the laboratory and their reactions were investigated by examination of the growing point at intervals. In non-vernalized sowings of the spring and the Rumanian alternative barleys the growing point elongated and differentiated the rudiments of the spikelets during the first 10–12 days while in the winter barleys it did not. Vernalization made little difference to the spring and Rumanian barleys, but in the winter varieties it caused marked elongation of the growing point.

During the winter 1934–35 the development of the growing point in vernalized and non-vernalized plants of all three types was studied in the field. The winter and Rumanian barleys both lagged behind the spring forms in this respect. Vernalization produced an acceleration in all forms. The winter was very mild and even the spring forms were little injured.

The results are discussed in the light of Lysenko's theory of phasic development. It is suggested that the Rumanian barleys differ from winter barleys in not having a well developed thermo-stage; they maintain the resting stage through the winter because of the shortness of the days. When the winter varieties have completed their thermo-stage and begin development in the spring, they are liable to be caught by spring frosts. Not so the Rumanian barleys which are still dormant, awaiting the longer days. This difference in the basis of hardiness makes the Rumanian barleys valuable in breeding for winter-hardiness, for it seems feasible to combine both types in one plant.

Crosses have already been made at Müncheberg between winter barleys and the Rumanian barleys (Cf. Abst. 1257) and the selection is to be carried out at the branch station Klein-Blumenau in East Prussia, where the winter is very cold, with usually only a slight covering of snow and with late spring frosts. A possible alternative method is that suggested by Lysenko, of selecting plants which survive the winter after vernalization.

1259. 633.16–2.42–1.521.6:575.11
TIDD, J. S. 632.42:576.16:633.16
Studies concerning the reaction of barley to two undescribed physiologic races of barley mildew, *Erysiphe graminis Hordei* Marchal.
Phytopathology 1937 : **27** : 51–68.

The reaction of 85 varieties of barley to two new physiological races of barley mildew designated 6 and 7 were tested. The new races necessitated the inclusion of a fifth variety, Heil's Hanna 3 C.I. 682, to the list of differential barley varieties cited by Mains and Dietz. Differences noted in the reaction of seedling and adult plants in the winter and in the late spring are probably due to environmental factors.

Five species of wild *Hordeum* proved to be immune to the disease. Svansota (susceptible to race 6) x Hanna (resistant) shewed that resistance is due to a single pair of mendelian factors with incomplete dominance. Similar results were obtained in the cross Featherstone x Goldfoil (resistant).

In the cross Arequipa (resistant) x Horsford (susceptible) resistance was due to a single pair of factors. There were indications that the inheritance of resistance was independent of the characters two rows versus six rows and hoods versus awns.

MILLETS AND SORGHUMS 633.17

1260. KARPER, R. E. and QUINBY, J. R. 633.174:575.125
Hybrid vigor in sorghum.
J. Hered. 1937 : **28** : 83–91.

The vigour of the F_1 hybrid as compared with the parent was studied in crosses between milo, kafir, Hegari, feterita, kaoliang, sorgo and broomcorn. For discussion the hybrids are arranged in four groups, in descending order of vigour.

In the first group, shewing maximum vigour in F_1, fall those hybrids which had milo or Hegari as one parent. Here hybrids of from twelve to fifteen feet were obtained from dwarf varieties, giving two and three times as much yield of fodder and grain as the more productive parent; the hybrids were also characterized by lateness of maturity. Hybrids between milo and Hegari were no more vigorous than those having only one of these varieties as a parent. Milo and Hegari apparently have many dominant genes in common and between them possess a majority of the favourable dominant genes in the genotypes of the sorghums used in these crosses.

The second group comprises those crosses giving intermediate vigour. These are of special interest from the commercial point of view for the vigour is shewn as yield of grain and forage rather than in height or lateness. The parents of the hybrids in this group are Blackhul kafir, Spur feterita and Sumac. These varieties differ visibly in many respects but the F_1 hybrids indicate that they differ genetically by only a few genes that affect vegetative growth. In the first group, on the other hand, varieties which were thought to be closely related, feterita and Hegari, shewed extreme vigour in the F_1 hybrids, indicating wide genetic differences. In the second group were found hybrids in which vigour was accompanied by earliness of maturity. The production of grain was about twice that of the parents.

The third group contains two crosses between closely related varieties, Dwarf Yellow milo x Dwarf White milo and Blackhul kafir x Red kafir. In the first cross there was an increased yield of grain and forage, possibly to be accounted for by the increase in tillering in the F_1. In the second cross the production of grain was more than twice that of the parents but was not accompanied by increased height.

The fourth group consisted of crosses between inbred lines of Blackhul kafir. The F_1 hybrids shewed no measurable increases in height of plant or other vegetative characters but increases up to 10 per cent in forage and grain yields were obtained, largely accounted for by increased tillering.

In an experiment in which emasculated heads of a waxy variety, Schroek, were pollinated with a mixture of pollen of Schroek and of non-waxy varieties, it was found that the hybrid seeds had heavier endosperms, a considerable part of the increase being due to hybrid vigour.

The possibilities of commercial utilization of hybrid vigour in sorghum by the production of F_1 seed in quantity are discussed.

1261. Marcy, D. E. 633.174–2.451.2–1.521.6:575.113.36
Inheritance of resistance to the loose and covered smuts of sorghum. I. Dwarf Yellow Milo hybrids.
Bull. Torrey Bot. Cl. 1937 : **64** : 209–28.

Marcy, D. E.
Inheritance of resistance to the loose and covered smuts of sorghum. II. Feterita hybrids.
Bull. Torrey Bot. Cl. 1937 : **64** : 245–67.

The resistant varieties used in these studies were Dwarf Yellow Milo and Feterita. The former maintained its resistance to both loose smut (*Sphacelotheca cruenta*) and covered smut (*S. Sorghi*) even under the conditions most favourable to infection, but Feterita shewed certain symptoms of infection by *S. Sorghi*, including blasting of the head. The susceptible varieties used were Shallu, Dakota Amber Sorgo, Dawn kafir and Sumac Sorgo.
As a result of the extensive studies the following genotypes are proposed: Dwarf Yellow Milo *RRbbss*; susceptible varieties *rrbbSS*; Feterita *rrBBss*. The factors *R* and *B* are factors for resistance and *S* is a factor for susceptibility. The factors governing reaction to *S. cruenta* may be the same as those governing reaction to *S. Sorghi* but the epistatic relations between them differ according to the smut concerned and according to the environmental conditions at the time of infection. Thus under one set of conditions for seedling inoculation the hybrids Feterita x susceptible varieties gave an F_2 segregation into 13 susceptible to 3 resistant but under another set of conditions gave 3 resistant to 1 susceptible.
It is suggested that this type of variable epistasis of opposing factors is of general importance in connexion with the inheritance of resistance to disease.

RICE 633.18

1262. Piacco, R. 633.18
Saggio di classificazione botanica dei risi coltivati. (**An attempt at a botanical classification of cultivated rices**).
Quad. Staz. Sper. Risic., Vercelli 1936 : No. 16 : Pp. 57.

The classification of Guščin is followed with certain modifications. (1) It is necessary to introduce the following characters: medium glumes, double grains, multiple spikelets. (2) A simplification of the classification of the pigments of the flowering glumes is advisable. (3) The pigmentation of the outer glumes cannot be neglected as there is no general rule of correlation between the pigmentation of the outer and flowering glumes. (4) The length of the spikelets should be considered more, as it is a character of major importance in agriculture. (5) The pigmentation of the apex of the flowering glumes should be regarded as a factor for differentiation. (6) The relation length–breadth of the spikelet should be used instead of that of the grain so that the so-called Carolina rices can be retained within the *proles indica*.
A key for the botanical classification of cultivated rices is given, followed by a chapter on the classification of rices cultivated in Italy, the majority of which can be grouped under the variety *italica* Alef.

1263. Chiappelli, R. 633.18:575(45)
Nuove varietà di riso al campo sperimentale. (**New varieties of rice in the experimental field**).
G. Risicolt. 1937 : **27** : 1–7.

Of the four varieties described, three, Senatore Novelli Gigante, Precoce Sesia and Rossi Gigante, are all derived from the natural cross Lady Wright x Chinese Ostiglia. The fourth variety, Piemonte, is the result of a natural cross between Lady Wright and Americano 1600.

1264. Piacco, R. 633.18:575.11.061.6:575.243
Il pigmento grigiastro del riso. (**The greyish colour of rice**).
G. Risicolt. 1937 : **27** : 12–15.

A study has been made of the dark grey pigmentation, a new characteristic which occurs in the artificially produced mutant of Mantova. The colour appears on the glumes after the grain has set and becomes pronounced as the grain assumes a waxy consistency.
The grey colour is a simple dominant over yellow. It is assumed that the original constitution of Mantova was *gg* (*g* = yellow) and that the treatment with light has changed it to the heterozygous condition of *Gg* (*G* = dark grey). No correlation has been observed between this pigmentation and other characters.

1265. Idsumi, Y. 633.18:575.125
[**Investigations in heterosis of rice plants (First report).**]
Proc. Crop Sci. Soc. Japan 1936 : **8** : 504–15.

The material examined consisted of the F_1 from 79 combinations obtained from 61 varieties of lowland rice. Heterosis was found to be most marked in features such as plant height, weight of stems, ear length, number of shoots and in over 80 per cent of the combinations the hybrid exceeded the average for both parents and in over 50 per cent it even exceeded the higher figures obtained for both parents. In many cases heterosis was exhibited in most of the above-mentioned characters simultaneously. There was no relation between heterosis and any positive or negative correlations existing between the various characters; nor had differences in the time of ripening of the particular pair of parents crossed any marked influence on the occurrence of heterosis. Neither did the degree of similarity or dissimilarity of the two parents, as regards the character or characters considered, necessarily increase heterosis, nor did a high degree of sterility in the F_1. Finally, the morphological differences between the Japanese and Indian types of rice plant bore no relation to the phenomenon, more heterosis being found in hybrids between Indian types than between Japanese and Indian forms.

1266. Sampietro, G. 633.18:575.243:575.11
Mutazione artificiale nel riso. (**Induced mutation in rice**).
Quad. Staz. Sper. Risic., Vercelli 1935 : No. 15 : Pp. 77.

The variety Mantova, a natural hybrid of Lady Wright x Chinese Ostiglia, was exposed to the light of an electric lamp in the laboratory during anthesis. Of the 17 seeds which germinated only three differed from the normal Mantova type. Two of these plants were slightly taller and later than Mantova, shewed a red coloration of the spikelets in contrast to the normal yellow and were medium in size in contrast to large. The other plant was much taller and later, shewed black coloration of the spikelets, the panicle was long instead of medium and the spikelets were medium sized.
In the F_2 and F_3 these off-types, designated A and B, shewed marked segregation in a number of characters which are described in detail.
The characters shewing mutation were:—the vegetative cycle, height, form of the spikelet, coloration of the apex and of the body of the flowering glumes, form of the panicle and coloration of the outer glumes.
There was no opportunity for a genetical analysis of the factors concerned except in the case of the colour of the flowering glumes for which two pairs of factors were found.
In conclusion, a number of anomalies found in the flowers of the mutant types are figured and described.

1267. Chevalier, A. and Viguier, P. 633.18:576.16
Sur la double origine des riz cultivées et le centre de dispersion rizicole Ouest-africain. (**On the duplicate origin of cultivated rices and the West African centre of dispersion**).
C.R. Acad. Sci. Paris 1937 : **204** : 1272–73.

A study of a large number of varieties of rice cultivated in the Sudan and from the districts

inundated by the Niger led to the conclusion that they were forms of *Oryza glaberrima* Steudel. Varieties of *O. sativa* have only been introduced since the 15th century by Europeans.
As to *O. Stapfii* Roxh. it has in Africa the same relation to *O. glaberrima* as *O. fatua* has to *O. sativa* in Asia.

1268. Piacco, R. 633.18:581.46:575
L'aristamento secondario nel riso. (**The secondary awning of rice**).
Ital. Agric. 1937 : **74** : 205–07.

Certain varieties of rice, including Mortara (var. *paraitalica* Piac.), used in the experiments have primary panicles which are completely awnless while the secondary panicles may be slightly awned.
Grains from awned and awnless secondary panicles were sown and all the secondary panicles of the F_1 were awned, the primary panicles all awnless.
In a second experiment grain from a number of awned secondary panicles was sown with grain from awnless primary and secondary panicles as controls.
All the resultant plants had awnless primary panicles, the secondary panicles were either awned or awnless and did not differ from the controls. The results of sowing the grain at different dates so that primary and secondary panicles developed under the same conditions did not alter the relations of the awned and awnless plants.
It is therefore concluded that the phenomenon is hereditary and a retarded inversion of the valency of the character pair awnless-awned by which the recessive becomes dominant is suggested in explanation.

1269. Reyes, G. M. 633.18–2.484–1.521.6:575.12
Rice hybrids *versus* stem rot disease.
Philipp. J. Agric. 1936 : **7** : 413–17.

Two rice hybrids, Raminad Strain 3 (Ramay x Inadhica Str. 3) and Eloninad (Elon-elon x Inadhica Str. 3) are described. Both are fairly resistant to stem rot and the first is also resistant to brown linear spot (*Cercospora oryzae*).

LEGUMINOUS FORAGE PLANTS 633.3

1270. Gollmick, F. 633.367:575.127.2:581.331.1
Über Artkreuzungen bei Lupinen. (**On species crosses in lupins**).
Züchter 1937 : **9** : 65–68.

The early development of the embryo was studied in the embryo sacs of several species of lupin after pollination with pollen of the same species and with pollen of a different species, with the object of throwing some light on the extreme difficulty of making interspecific crosses between Mediterranean species.
It was found that the hybrid embryos developed much more slowly than the controls, reaching in 100 hours approximately the same stage as the non-hybrid embryos reached in about 44 hours, with a short suspensor and a few-celled embryo. After about 120 hours the hybrid embryos begin to disintegrate.
The stage at which the embryo aborts is too early to give much hope of artificial culture of hybrid embryos. It is possible that in the favourable conditions of the centre of origin of lupins hybrid embryos may develop sufficiently to give rise to viable seeds.

1271. Berland, S. S. and Šmygun, V. N. 633.367:581.192.6:575
(**Rapid multiplication of the sweet lupin in the early stages of breeding**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 12 : 61–66.

The low rate of seed production of the lupin is partly due to the failure of the flowers to become pollinated, which can be largely overcome by gently pressing the flowers between the fingers in a given manner; in this way an increase in yield of seed of 14–17 per cent has been effected. Rapid multiplication of the new sweet lupins is also achieved by vegetative reproduction, cuttings being the most successful.

1272. Fedotov, V. S. 633.367:581.192.6:575
(Characteristics of the varieties of low-alkaloid and alkaloid-free lupins).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 12 : 66–72.

The entirely alkaloid-free lupins are badly attacked by aphides and other insects, and the most desirable type would seem to be one with about 0·1 per cent alkaloid, which is enough to keep off the insects but does not make the plant poisonous. One line of *Lupinus angustifolius* with an alkaloid content of 0·06–0·08 per cent in the seed which is nevertheless resistant to insect attack has, however, been found.

Descriptions are given of a number of promising lines, with indications of their origin. Among them is a new form "White Seeded Yellow" lupin with low alkaloid (below 0·03 per cent) and remarkably high protein content (48 per cent) which is therefore suitable for ordinary use as a vegetable.

Another new hybrid of *L. angustifolius* combines alkaloid freedom with early maturity (8–15 days before the average), vigorous growth and resistance to *fusarium* and bacterial attack.

The results of hybridization have shewn alkaloid content in both *L. luteus* and *L. angustifolius* to be dominant when the bitter type is used as maternal parent; with the sweet lupin as maternal parent the hybrid seeds are intermediate in alkaloid content. The seeds (F_2) produced by the F_1 plants do not display any segregation.

1273. Sengbusch, R. v. and Zimmermann, K. 633.367:581.47:575
Die Auffindung der ersten gelben und blauen Lupinen (*Lupinus luteus* und *Lupinus angustifolius*) mit nichtplatzenden Hülsen und die damit zusammenhängenden Probleme, insbesondere die der Süsslupinenzüchtung. [**The discovery of the first yellow and blue lupins (*L. luteus* and *L. angustifolius*) with non-splitting pods, and the problems connected therewith, especially those of sweet lupin breeding**].
Züchter 1937 : **9** : 57–65.

An account is given of the search for non-splitting types in these two species, involving millions of plants. Plants shewing the non-splitting character in the field in seasons favouring splitting, such as 1929 and 1935, were selected as élite plants and given progeny tests. Progeny tests were also carried out with unselected plants. Tests were also made with artificial methods in which the plants were subjected to high temperatures and low humidity but, judging from the progeny tests, they were of little value.

One family of *L. luteus* was very strongly non-splitting and it was found that in this case the character was based on a morphological difference from the normal. In the normal type the ventral suture has two vascular bundles each accompanied by a separate strand of sclerenchyma and the dorsal suture has one bundle accompanied by a divided strand of sclerenchyma. The pod splits between the two ventral strands and through the division in the dorsal strand. In the non-splitting type the two ventral strands of sclerenchyma are united and the dorsal strand is undivided, with the result that the forces developed in the walls of the pod are not sufficient to split it. Nothing is known as yet about the genetics of this character.

Non-splitting types were also found in *L. angustifolius* but here the character is not based on such a clear-cut morphological difference and appears rather to be a complex character.

It is not intended to give up the search for further non-splitting types, as it is now considered that it was a mistake to stop looking for more alkaloid-free types after one had been found. Other methods which were being pursued with non-splitting lupins as objective were the artificial induction of mutations (the treated material will undergo selection in 1937), the use of forms from the natural home of the lupin, the Mediterranean region, and the building up of the character from component characters (Cf. "Plant Breeding Abstracts", Vol. VII, Absts. 674 and 996). These methods were thought to be more likely to succeed than selection among local varieties, but since it is precisely this method which has so far succeeded, more attention is to be devoted to it in the future.

1274. CLARK, C. F., METZGER, C. H., MILLER, J. C., STUART, W. and YOUNG, L. C. 633.491:001.4
Report of potato variety nomenclature committee.
Amer. Potato J. 1937 : **14** : 81–85.
This report emphasizes the importance of a satisfactory definition of a potato variety and a potato strain, the need for true-to-name varieties and the necessity for maintaining original stocks for purposes of comparison and character study.

1275. MILLER, J. C. 633.491:575
A discussion of the problems of potato research.
Amer. Potato J. 1937 : **14** : 75–78.
An outline of some of the problems still awaiting solution.

1276. MACLEOD, H. S. and JONES, W. 633.491:575(71.1)
633.491 Columbia Russet
A new potato variety from British Columbia.
Amer. Potato J. 1937 : **14** : 93–99.
A description of a seedling of the Wee McGregor variety. It is an early main-crop sort with a good yield and satisfactory cooking quality. It is not particularly resistant to disease but is less susceptible to common scab than the Green Mountain variety.

1277. STEVENSON, F. J. *et al.* 633.491:575(73)
Potato breeding - 1935.
U.S. Dep. Agric., Div. Fruit & Veg. Crops & Dis., Wash. 1936 : Pp. 70. (Mimeographed).
The work on potato breeding, organized in co-operation with several of the State experiment stations is reviewed. A considerable amount of work is being done on disease resistance. Selection, hybridization and cytological investigations are also in progress.

1278. EMME, E. K. 633.491:575.11.061.6
(The genetics of the potato. I. Inheritance of corolla colour in 24 chromosome species of the potato).
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1936 : **5** : 977–1000.
Data resulting from crosses between species of the *Tuberosa* group form the main basis of this paper, though *Emmeae*, belonging to the *Pinnatisecta* group, was used in three cases and a few crosses were also made between 24-chromosome species and 36-, 48- and 72-chromosome forms. Very great variation prevails in the colour of the flower of the 24-chromosome forms and their hybrids, pure white, cream, light or dark reddish purple, raspberry, light or dark blue, and bluish purple, all in various shades being recorded. The acumina may be white on red-purple flowers; and the base of the corolla may be greenish, silvery, cream, yellow, brown or self-coloured, while the upper and under surface of the corolla may be of different colours, probably owing to the action of independent genes.
The following genetic factors have been provisionally postulated as operating to produce the various colours observed: An^{sp}, the gene for the presence of anthocyanin on the upper surface of the corolla; An^{inf} the corresponding gene for anthocyanin pigmentation of the under surface; *Cr* and *Cy* genes respectively reducing and raising the *p*H in the cells of the corolla and thereby causing in the first case the production of a shade ranging from reddish purple to raspberry red and in the second case a shade of blue-purple or blue; a further factor *Fl* is tentatively postulated for the presence of yellow pigments in the cell sap. It is thought likely that the loci of *Cr* and *Cy* are the sites of a series of allelomorphs conditioning the infinite variety of intensity of the colours due to these two genes. Absence of anthocyanin is regarded as the cause of absence of colour, i.e. white.
From the cross *Emmeae* x *Rybinii*, it is deduced that the constitution of *Emmeae* was an^{sp}, an^{inf} and *cr* while *Rybinii* carried an^{sp} an^{inf} and probably *Cr cr*. The cross *Emmeae* x *goniocalyx*

indicated that the latter clone was of the same constitution as *Rybinii* as regards colour. A further cross between *Kesselbrennerii* and *Emmeae* suggested that *Emmeae* contained *Cy cy*, *Cy* being completely epistatic to *Cr*, while *Kesselbrennerii* was apparently heterozygous for An^{sp} and homozygous for *Cr*—a condition also found in *boyacense* on analysis of the crosses *Rybinii* x *boyacense*. A difference in the colour of the acumina, which were reddish purple in *Kesselbrennerii* and white in the *boyacense* race, is attributed to a possible mutation.
In a cross between *boyacense* and *canarense* white acumina were recessive to coloured.
The constitution of *aracc-papa* was deduced from hybridization with *Rybinii* and with *boyacense* to be An^{sp} An^{sp} *Cr cr** *Cy Cy*, a result further supported by the data from a *Kesselbrennerii* x *aracc-papa* cross. The most probable genotype for *goniocalyx* was deduced as an^{sp} an^{sp} *Cr cr* from an *aracc-papa* x *goniocalyx* cross; while *goniocalyx* x *Bukasovii* indicated that the latter component was probably of the constitution An^{sp} An^{sp} *Cy Cy*. *Rybinii* x *Bukasovii* resulted in 25 seedlings, all with blue-purple corolla.
Other forms analysed in similar fashion were *S. stenotomum*, *ajanhuiri*, *phureja* and *verrucosum* and the F_1 results of a number of crosses between 24 chromosome and higher polyploid species are tabulated.
As regards dominance, in general, blue appears to be dominant to red, and both blue and red to white. Blue purple on the under surface of the corolla is a dominant. White corollas with coloured under surface, etc. are found among *Tuberosa* forms of Peru, Columbia and Chile. Bright raspberry red is found only in the *Kesselbrennerii* and *boyacense* of Columbia, while forms lacking all anthocyanin coloration are found only in the *Pinnatisecta of* the Argentine and Uruguay.
Various hypotheses on the genotypic basis of corolla colours in the potato and the possible underlying biochemical reactions are considered in the introduction.

1279. LUNDEN, A. P. 633.491:575.11.061.6
Arvelighetsundersøkelser i potet. [**Inheritance studies in the potato (*Solanum tuberosum* L.)**]. Meld. Norg. LandbrHøisk. 1937 : **17** : 1–156.

The results of variation statistics of the author and other investigators shew that the duplicate or "homomere" factors found in the potato do not segregate independently but their behaviour is in accordance with the modified segregation ratios determined by autotetraploid inheritance. This holds especially for the colour factor *P* and for the immunity factor *X*. The results for *D* do not shew such a close agreement and this is due to a different degree of double reduction.
Most of the plant material was the result of controlled pollination. About thirty varieties of potato were used in the experiments. With regard to tuber colour two types have been observed, one in which the periderm is coloured and the underlying parenchyma tissue is colourless or is slightly coloured and the other in which the periderm is colourless and the colour is deposited in the outermost layer of the cortex. Of the varieties investigated, only Centifolia and Sickingen belong to the first type which is designated $Rød^1$ or R^1. The second type is $Rød^2$ or R^2.
The inheritance of colour of tubers, sprouts, stems, flowers and inflorescence colour was studied and the following factors were found to be concerned in the inheritance:—
R = factor for red tuber colour (type 2). Also causes coloration of the stem internodes, petioles and inflorescences. *Rd* plants have pale red or nearly white tubers.
E = factor for red tubers (type 1). Also causes coloration of the stems, especially of the wings and the wings of the leaflets, the callus, the young roots at the base of the sprout and flowers. *Ed* plants have very pale red tubers and white flowers.
D = a complementary factor to both *R* and *E*. Together with *R* it gives red tubers (type 2) and increases the effect of *R* in the stem, leaf and inflorescence. With *E* it increases the coloration of the stems, wings and callus, and gives red tubers (type 1) and red purple flowers. In the absence of *R* and *E* it gives some anthocyanin colour in the stem and inflorescence as well as red-purple sprouts with coloured tips. *D* is also complementary to *F*, the factor for flower colour.
F = factor for flower colour. Gives red-purple flowers in the presence of *D* (and *G*).
P = factor for blue-purple colour (anthocyanin). Changes both the red tuber-colour type

* Given as *Cr Cr* in the text, presumably in error. Abstractor's Note.

and the red-purple flower colour to blue-purple. Gives (in absence of *D*) together with *R* and *E* pale blue-purple tubers of both colour types; in type I also light blue flowers. It causes also a blue-violet coloration of the sprouts and some colour in the stem and inflorescence. Together with *F* in the absence of *D*, *P* gives pale-blue to blue flowers.
G = complementary factor for flower colour besides *D* and *F*.
S = factor for the distribution of colour on the surface of the tuber. It causes characteristic dark and light areas on the same tuber. With the exception of *S* and possibly *G*, all these factors are dominant in the simplex condition and their action is intensified as the number of the factors increases.
A case of natural crossing was observed between the varieties Louis Botha and Centifolia. Insects are thought to have been the most likely agents.
A white-flowered bud mutation found in the variety Jubel proved to be a monoclamidius epidermal-periclinal chimaera.
The inheritance of chlorophyll deficiencies was investigated and the following factors were identified.
W = a dominant factor that gives normal chlorophyll formation in the simplex condition (*Wwww*); *wwww* plants are albinos.
V = also a dominant factor that gives normal chlorophyll formation in the simplex condition; *vvvv* plants are yellow-green.
The investigations on immunity to *Synchytrium* involved over 7,000 plants which included over 20,000 tubers. The factors involved were:
X = a dominant factor causing immunity in the simplex condition and independent of any other immunity factor.
Y and *Z* = complementary factors that cause immunity when both are present even in the simplex condition. They are independent of *X* both in effect and in inheritance. *Y* and *Z* segregate independently of each other.
No linkage has been observed between the immunity factors and the colour factors *E*, *R*, *D*, *P* or *F*.

1280. Propach, H. 633.491:576.354.4:576.356.5
Cytogenetische Untersuchungen in der Gattung *Solanum*, Sect. *Tuberarium* I. Die Sekundärpaarung. (**Cytogenetic investigations in the genus *Solanum*, section *Tuberarium* I. Secondary pairing**).
Z. indukt. Abstamm. -u. VererbLehre. **1937** : **72** : 555–63.

The author discusses the significance of fixation and interpretation in connexion with secondary association and suggests that it should only be taken as significant evidence for homology when primary associations of similar valency also occur. He gives his own results on 100 second metaphase plates in each of the following forms: *S. chacoense*, 2n = 24, the hybrid *S. acaule* x *S. chacoense*, 2n = 36, *S. ajuscoense*, 2n = 48 and *S. demissum* forma *xitlense*, 2n = 72. The frequencies with which groups of different valencies occurred are set out both in tabular and graphical form and it is shewn that the higher the degree of polyploidy the more frequent are the groups of high valency and the higher the highest group. Thus the highest association in *S. chacoense* was 4, in the 36-chromosome hybrid, 5 and in *S. ajuscoense* 8 and so on. Since the corresponding primary associations (multivalents) were not observed at diakinesis or first metaphase it is concluded that this is simply a matter of chance and the more chromosomes there are in a plate the better chance they have of running together under the influence of fixation to form apparent associations of high valencies. Hence secondary association in these forms cannot be taken as evidence of homology and the basic number for this section of the genus is to be taken as 12.

1281. 633.491:576.356.5:575.127.2
Emme, E. K. 633.491–2.411.4–1.521.6
633.491–2.8–1.521.6
(**Triploid hybrids of the species of *Solanum Antipoviczii* Buk. sp. coll. which are immune to phytophthora**).
Biologičeskii Žurnal (Biologicheskij Zhurnal) **1936** : **5** : 901–14.

Crosses (yielding 14 plants) were made between *S. Rybinii* (n = 12) and the varieties of *S.*

Antipoviczii, variety *Ganderae* and variety *Reddickii* and also *S. ajuscoense* var. *candelarianum* which have 24 as their haploid chromosome number. Crosses were more easily obtained with the tetraploid as the female parent, a fact which may, it is suggested, perhaps be attributed to the relatively greater energy of growth of the *Rybinii* pollen corresponding to its larger style as compared with *Antipoviczii*.
In the F_1 hybrids, which were sterile, the somatic chromosome number was 36. Indications of autosyndesis with the formation of 18 units at first metaphase and also of an apparently more or less regular disjunction of the 18 partners lead the writer to suggest that the basic number in *Tuberarium* may be 6 and not 12.
There was almost complete dominance of the morphological characters of the 48 chromosome parents, e.g. habit, leaf type, structure and colour of the flower, structure of the calyx, stamens, pistil, etc.
The scanty pollen of the F_1 hybrid from *ajuscoense* x *Rybinii* comprised small and shrivelled as well as well-filled grains and in one seedling small, medium and giant grains were observed.
All the triploids obtained are resistant to *Phytophthora* and to virus disease.
Incidentally, a cross of *boyacense* by *Rybinii* was also successful.

1282. 633.491:581.46:581.143.32
KAUSCHE, G. A. 633.491(8)
Über einige Anomalien in der Kartoffelblüte. (**On some anomalies in potato flowers**).
Z. PflKrankh. 1937 : **47** : 113–39.

The material studied included South American species as well as cultivated European types. The anomalies are divided into three types. The first type, failure to flower and premature dropping of the flowers, is common when the South American potatoes are cultivated in Europe. The second, called "gross" anomalies, involves one part of the flower taking on the form or function of another or deformations of different parts and affects the European varieties more than the primitive South American forms. The third type, anomalies of the sporogenous tissues and organs, is again to be found in South American forms cultivated in Europe.

1283. LIVERMORE, J. R. and WERNER, H. O. 633.491–1.421
Report of the committee on standardization of field plot technique.
Amer. Potato J. 1937 : **14** : 45–55.

Recommendations for the methods of carrying out field trials wth potatoes are given, covering questions of seed stock, location, planting and care, harvesting, grading, testing for yield, replications, roguing, design (with special reference to the question of systematic or randomized plots), statistical analysis and interpretation.

1284. STAPP, C. 633.491–2.3–1.521.6:575
Weitere Beiträge zur Frage der Widerstandsfähigkeit verschiedener Kartoffelsorten gegen Schwarzbeinigkeit und Knollennassfäule verursacht durch *Bacterium phytophthorum* Appel. (**Further contributions on the question of the resistance of various potato varieties to black leg and tuber wet rot caused by *B. phytophthorum* Appel**).
Angew. Bot. 1937 : **19** : 141–52.

The reaction of 25 approved commercial varieties of potato to *B. phytophthorum* were tested in the field. Only one of the varieties, Sickingen, was highly resistant. The variety "Frühe Hörnchen" was not very susceptible.
No certain relation was found between resistance and time of ripening, thickness of the skin, capacity for the formation of wound cork, starch content or rate of decomposition of the parenchyma of the tuber. It was, however, observed that of the 12 very susceptible varieties 11 were yellow fleshed and a previous experiment had given 7 yellow fleshed varieties among the 8 susceptible sorts.
An increase in virulence in one of the strains of *B. phytophthorum* cultivated since 1928 was observed.

1285. 633.491–2.4–1.521.6:575
DARLING, H. M. 633.491–2.4:581.49
A study of scab resistance in the potato.
J. Agric. Res. 1937 : **54** : 305–17.

The reaction of inbred lines and hybrid seedlings to *Actinomyces scabies* (Thax.) Güssow was tested by growing them alongside susceptible varieties in scab-infested soil. Resistant seedlings were found in each class, including some which arose by inbreeding from a susceptible parent variety. No immune forms were found.

The progeny of certain inbred resistant seedlings were nearly all resistant and the progeny of certain susceptible seedlings were all susceptible; other susceptible seedlings, however, produced both susceptible and resistant progeny. Considerable variation was also noted in certain F_1 hybrid progenies.

A study of the early tuber development in a susceptible and a resistant seedling suggested that lenticel structure was important in determining resistance. The lenticels of the susceptible seedling were much larger and the complementary cells were rounder and more loosely arranged. Further protection was afforded the resistant varieties by earlier suberization of the periderm and by the extension of the suberization further into the lenticels.

Resistance is not necessarily associated with russet skin, for resistant seedlings with smooth skins were found.

It is considered that the prospects of producing a scab-resistant commercial variety are good.

1286. 633.491–2.411.4–1.521.6
LEHMANN, H. 632.411.4:576.16
Das heutige Ausgangsmaterial für die Züchtung *Phytophthora*-widerstandsfähiger Kartoffeln. (Unter Berücksichtigung der bisher aufgetretenen Biotypen von *P. infestans* de Bary). [**The present-day foundation stocks for the breeding of *Phytophthora*-resistant potatoes. (With regard to the biotypes of *P. infestans* de Bary which have so far appeared).**]
Züchter 1937 : **9** : 29–35.

The reaction of wild *Solanum* species in the Müncheberg collection to the eight physiological forms of *P. infestans* now known are given in tabular form, based on artificial infection experiments. Three groups of species are distinguished: firstly, those susceptible to all physiological forms, namely all strains of *S. chacoense*, *S. acaule* and *S. Fendleri* and nearly all *S. verrucosum* strains; secondly those resistant to some forms and susceptible to others, including the remaining *S. verrucosum* strains, all *S. Antipoviczii*, *S. demissum* Lindley strains and also *S. demissum utile* which has been much used in breeding, but which is somewhat susceptible to form 8; the third group comprises species which are resistant to all forms, namely *S. polyadenium*, *S. demissum Tlaxpehualcoense*, *S. ajuscoense* and *S. demissum El Desierto*.

The results are discussed in relation to the breeding problems, field observations by other workers and the need for further work on biological specialization in *Phytophthora*.

1287. SIDOROV, F. F. 633.491–2.411.4–1.521.6:575
(Wild species of the potato in breeding for immunity to *Phytophthora*).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 2 : 34–35.

The main substance of this paper has already been reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 614. Details are given here of the desirable features, including immunity to *Phytophthora*, high yield and in some instances frost resistance too, observed in *Solanum demissum* x *tuberosum* hybrids. In the F_2 of crosses between *S. Antipoviczii* and *S. tuberosum*, the immunity is more marked and the yield of tubers and the starch content are often higher than in the *S. demissum* hybrids.

1288. Schultz, E. S. *et al* 633.491–2.8–1.521.6:575.11
Recent developments in potato breeding for resistance to virus diseases.
Phytopathology 1937 : **27** : 190–97.

Katahdin and Seedling 41956 were found to be highly resistant to latent mosaic in field exposure tests. Katahdin, however, can be infected with the disease by grafts with the latent mosaic variety, Green Mountain. S 41956 remained resistant in spite of severe inoculation and grafting tests.

A wide range of variation in the reaction of seedlings of Green Mountain to veinbanding mosaic makes it probable that tolerant or highly-resistant seedlings may be produced. Katahdin is resistant to mild mosaic but as shewn by the 9 per cent of susceptible progeny when selfed, it is not homozygous. The results of selfing and of the cross No Blight x Katahdin, namely, resistant 86 : 14 susceptible, shew that the resistant character is inherited as a dominant. There was great variation in the symptoms of spindle tuber produced on different varieties, but no proved case of resistance.

A similar variation in symptoms was found for leaf-roll. A more efficient method of testing for this disease is necessary, as in field exposure tests many of the susceptible controls escaped the disease.

1289. Wolcott, G. B. 633.492:576.312.32
Chromosome numbers in the Convolvulaceae.
Amer. Nat. 1937 : **71** : 190–92.

In eight species of *Ipomoea* the somatic number was found to be 30.

FIBRES 633.5

1290. 633.5(47)
(New technical plants).
Bull. Appl. Bot. Leningrad 1936 : Ser. XI (1) : Pp. 205.

In addition to papers by L. V. Kaminer on New Zealand flax, by I. A. Žigarevič on *Eucalyptus* and by P. F. Medvedev on *Sesbania*, as fibre plants for the U.S.S.R., the following papers are of interest:

P. F. Medvedev. *The mallow—a new technical plant of the north.* (*pp. 3–29*).

A note on the history of the mallow as a crop plant and the botanical description of *Malva meluca* are followed by observations on growth and flowering, requirements as regards climate and soil, cultivation, yield of seed and stem, the quality of the latter and the possibility of utilizing the seed as a source of oil.

Individual selection and hybridization—interspecific and possibly also intergeneric—should be tried as a means of improving the fibre quality. *Sida* and *Anoda* are regarded as promising material for crossing with the mallow owing to their less brittle fibre.

I. K. Iordanova and Bograd, L. I. *Solidago—a new rubber bearing plant in the Soviet Union.* (*pp. 31–58*).

This paper deals with the history of the introduction of *Solidago* into cultivation in the U.S.S.R., the geographical distribution, ecology, botanical description and systematic classification of the genus are outlined with notes on the biology of development in various species, on their rubber content and on prospects and methods of cultivation.

G. A. Pereverzev. *On the biology of flowering of Crotalaria juncea L.* (*pp. 59–78*).

The treatment of the subject includes information on pollination technique, fertility, apogamy and the relative set from early and late forms.

P. F. Medvedev. *On the intra-racial variation of Formosa ramie.* (*pp. 159–73*).

The necessity for applying technical tests for quality and yield to eliminate inferior types in the early stages of breeding work is evident. The methods of individual selection, inbreeding and hybridization are described shortly and the results of a study of specimens of Formosan ramie are set out to shew the relationships between fibre content and the following features: sex; colour and shape of inflorescence; colour, weight, length, pubescence, thickness and internode length of stem; and finally the stage of development. Differences in the yields of bast and fibre were noted in ramie from Morocco, China, France and Formosa.
The breeder's aim should be to obtain the largest bulk of stem combined with the highest yield of fibre.
Short internodes, which usually accompany marked pubescence, should be eliminated in breeding.

P. F. Medvedev. *Fibre plants in the wild flora of the Soviet Union.* (*pp. 185–205*).

On the numerous wild fibre plants of the U.S.S.R., their botanical classification, distribution and their various economic uses.

1291. 633.51(73)
JONES, V. H. 633.51:677.1:575
A summary of data on aboriginal cotton of the Southwest.
Univ. N. Mex. Bull. 1936 : No. 296 : 51–64.

A survey of the anthropological, historical and other literature on this problem. Aboriginal cotton of the southwest U.S.A. probably all belongs to the one species *Gossypium hopi* Lewton, a relative of *G. hirsutum*. This species is unique in combining fineness of fibre with short staple length (about 0·8 inch) and is being used by the United States Department of Agriculture in breeding a fine cotton of medium staple length.

1292. ŽUKOVSKII, P. M. 633.51:575(47)
(On the cotton regions of Azerbaijan).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : 24–28.

In discussing general conditions in the cotton area the need for cotton varieties that are resistant to diseases and pests is indicated and some new selections from the American form "Special Mead" are mentioned. Breeding work is in progress with Sea Island and Egyptian types, but various defects have still to be eliminated.

1293. 633.51 *G. barbadense*:575(47)
AVTONOMOV, A. 633.51:575.127.2
(What is new in breeding Egyptian cotton).
Bor'ba za Khlopok (Cotton Campaign) 1936 : No. 7–8 : 159–60.

Breeding work was started in 1931, with the object of producing an Egyptian cotton comparable with the Upland varieties in yield and earlier in maturity. Varieties have now been produced which exceed Maarad in earliness by 10–12 days, e.g. No. 35-1 with lint 36–38 mm. and No. 35–4 with lint 40–42 mm. in length, both having bolls of medium size and yielding 10–15 per cent more than Maarad.
In the attempt to effect still further yield increases the Egyptian cottons are being crossed with the large-bolled perennial Peruvian cottons. The F_5 in 1936 contained some very uniform families in which the weight per boll equalled 5–6 grm. and the lint length 38–43 mm.; the time of ripening was mostly about the same time as Maarad but in some promising families was 2–3 days earlier.

1294. 633.51:575(54)

The Indian cotton situation, 1929-35.

Int. Rev. Agric. 1936 : **27** : T 405–21.

In the brief section on breeding and genetics the history of cotton cultivation in India is reviewed and some of the new strains selected since 1900 are noted. Selection is carried on for improvement in the quality of the fibre as well as for yield and for hardiness and resistance to diseases and pests.

The article deals with the geographical distribution of the cotton plant throughout India, the soils, methods of cultivation and the systems of irrigation.

1295. Hancock, N. I. 633.51:575(76.8)

Cotton varieties and related studies.

Bull. Tenn. Agric. Exp. Sta. 1936 : No. 158 : Pp. 46.

An account is given of variety trials in Tennessee, with remarks on the qualities of the strains tested. Other topics covered briefly include vicinism, fibre length, breeding requirements and seed supply. In connexion with seed the value of one-variety communities is mentioned.

1296. Svetašov, A. T. 633.51:575:677.1

(**Breeding in the campaign for lint quality in cotton**).

Bor'ba za Khlopok (Cotton Campaign) 1936 : No. 6 : 33–40.

The new varieties 8517, 36 M2 and 2034 have much better lint quality than the earlier varieties such as Navrotskii. The quality of the new Egyptian varieties is extremely high and their cultivation is being more and more extended. They are still low in yield, however, owing to their average boll weight, which is 3·3·5 grm. as compared with 6–6·5 in the case of Uplands such as No. 8517. Their ginning out-turn is also low. In the attempt to raise the boll size they have been crossed with the large bolled perennial cottons from Brazil and Peru, in the third and fourth generations of which crosses forms have segregated with bolls of 4·5–5 grm. in weight and these are being subjected to further selection.

Breeding is also being done with Upland cottons to increase their lint length, the variety Wilds, serving as the chief starting point. One of the selections, No. 902–16, has lint 35·3 mm. in length and exceeds Navrotskii by 9 per cent in yield of lint. Other selections have lint of up to 37–40 mm. in length. All these selections are somewhat later in ripening but are earlier than the Egyptian varieties, which they also exceed in yield; some of them may therefore be able to replace the Egyptian varieties in certain districts.

In the attempt to increase the earliness of these forms, crosses were made in 1932 between long-stapled American cottons and the earliest maturing selections. Selection was made in the second generation and out of 773 selections made in the following year all but ten exceeded the standard and the early parent in lint length; the majority were earlier than Navrotskii and many exceeded it in yield. Certain families combined long lint, earliness and high yield.

1297. Chi-Pao, Y. and Yuen-Ling, H. 633.51:575.11

(**Studies on the inheritance of Chinese cotton**).

J. Agric. Res., Nat. Cent. Univ., Nanking 1934 : **1** : No. 2 : 135–68.

The following allelomorphs affecting the colour of the centre of the flower (spot) were established: *R* (red centre) R_y (yellow centre) and *r* (white centre). *R* is dominant over R_y and *r*, but the heterozygote $R_y r$ has a red centre, segregating into 1 yellow : 2 red : 1 white on selfing.

In studying the inheritance of leaf shape, Leake's leaf factor was found to be better than the leaf index. A single factor pair *Cf* (deep serration), *cf* (shallow serration) was found to be operating, with incomplete dominance.

The presence of glands on the leaf was determined by a single dominant gene *Ne*, the glandless condition (*ne*) being recessive.

Red petal margin was conditioned by a single factor *We*, the recessive *we* producing no red margin.

The following factors for colour of stem were found P_y, P_o, p_o and p_o^s. P_y produces the purple stem of yellow-centred Chinese cotton, P_o the purple stem of ordinary Chinese cotton,

p_o green stem (red colour under green epidermis) and p_o^s sun-red. When yellow-centred, purple-stemmed Chinese cotton was crossed with yellow-centred, green-stemmed cotton the F_2 segregated into 12 purple : 3 green : 1 sun-red. Yellow-centred, purple-stemmed Chinese x purple-stemmed Fenghsien cotton gave an F_2 segregation into 15 purple : 1 sun-red.
Yellow petal colour was incompletely dominant over white or cream, giving 3 : 1 segregation in F_2 of crosses yellow x white or yellow x cream.
The genes for petal colour and colour of flower-centre were independent in inheritance. The latter was also shewn to be independent of the factor for leaf shape and the former, of the factor for glands. W. T. C.

1298. Chi-Pao, Y. 633.51:575.11.061.6
(Amount of chlorophyll in Chinese cotton).
J. Agric. Res., Nat. Cent. Univ., Nanking 1934 : **1** : No. 2 : 109–34.
Considerable varietal differences in chlorophyll content were observed. In F_1 hybrids the chlorophyll content was less than in either parent. The content was nearly identical in direct and reciprocal hybrids, suggesting that the character is subject in this case to nuclear rather than to plasmatic control.
There appeared to be some correlation between the period of ripening and the chlorophyll content. W. T. C.

1299. 633.51:575.12:581.143.26
Deger, E. 633.51–2.7–1.521.6
Una variedad de algodón para el porvenir. **(A cotton variety for the future).**
Rev. Agríc. Guatemala 1936 : **14** : 148–49.
A new hybrid between perennial and Upland cottons is described. It is perennial in habit, resistant to the two main pests *Anthonomus grandis* Boh. and *Gelechia gossypiella*, gives a prolific yield of bolls both in humid tropical regions and in more temperate zones; its abundant lint is of superior quality, silky, very glossy, smooth, long, strong and perfectly white.

1300. Brown, H. B. and Cotton, J. R. 633.51:575.242:581.45
"Round-leaf" cotton. Notes on the appearance and behavior of a peculiar new strain.
J. Hered. 1937 : **28** : 45–48.
A cotton plant with rounded leaves found in 1930 among a block of Upland cotton is described. It bred true to type but each year bud mutations have appeared on some of the plants.
Crosses of the mutant with normal Broad-leaf plants and with Okra-leaved plants shewed an approximation to a di-hybrid ratio, but some Broad-leaved plants and other types unexpectedly turned up in the cross with the Okra-leaved strain.
The chromosomes are apparently normal.

1301. Guimarães, C. L. 633.51:575.42(81)
O ensaio de variedades como base da selecção de typos de algodoeiros para as differentes zonas do estado de Minas Geraes. **(Variety testing as a basis of selection of types of cotton for the different zones of the state of Minas Geraes).**
Bol. Minist. Agric. Rio de J. 1936 : **25** : 69–79.
The importance of growing only one variety in each region is emphasized and hence the necessity of reliable methods of determining the varieties most suitable. It is then necessary to practise selection to improve the agronomic and industrial qualities and the method of plant-to-row selection is described.

1302. Correa y Elias, A. 633.51 Tangüis:575.42(85)
Resultados de la selección del algodón Tangüis en el valle de Cañete. (**Results of selection in Tangüis cotton in the Cañete valley**).
Ministerio de Fomento, Asociacion de Hacendados de Cañete, December 1936 : Pp. 49.

Selection has been practised for the production of strains true to the original Tangüis type and at the same time resistant to wilt. Attempts to reproduce the Tangüis type by crossing have failed and the work was carried out on the basis of the material still available, which was thought not to be identical with the original Tangüis, which was heterozygous and has given rise to a somewhat varied progeny.
Detailed observations have been made on a progeny of a single plant selection made in 1926; the lint is 1¼" to 1$\frac{3}{16}$", uniform, strong and tough, semi-rough, lint percentage 38·9 and lint index 7·12; the seeds are small, naked and brown; the percentage of brown lint has been reduced in the course of selection from 15–16 to under 5 per cent. The wilt infection is much reduced and the strain has been multiplied and seed is now being distributed.

1303. Quinby, J. R., Killough, D. T. and Stansel, R. H. 633.51–1.421
Competition between cotton varieties in adjacent rows.
J. Amer. Soc. Agron. 1937 : **29** : 269–79.

In two series of experiments no consistent, statistically significant effect of competition between adjacent rows of different varieties of cotton was detected. It appears safe therefore to use single row plots and use the space thus saved for additional replications. To guard against possible competition effects which have not been detected, randomization is essential.

1304. Tondeur, G. 633.51.00.14(67.5)
Rapport de la station de sélection cotonnière de Bambesa. (**The report of the Bambesa station for cotton selection**).
Bull. Agric. Congo Belge 1936 : **27** : 578–92.

The multiplication of seeds of selected cottons has been the main work of the station and the report is therefore devoted to a detailed description of the methods of cultivation employed.

1305. 633.52:575(47)
Mitrofanova, N. 633.52 Stokhanovets
(**New varieties of flax**).
Len i Konoplja, Moskau 1936 : **13** : 27–29.

Among the varieties bred from local Russian forms high-yielding and resistant to rust and *Fusarium*, the variety "Stokhanovets" is specially mentioned.

1306. Miège, E. 633.52:575(64)
La culture du lin au Maroc. (**The cultivation of flax in Morocco**).
Serv. Agric. Colon., Centre Rech. Agron. Rabat 1936 : 27th Novembre, Pp. 25.

The position of flax cultivation in Morocco is briefly reviewed. Experiments with imported varieties of flax demonstrated the superiority of the indigenous variety *Linum usitatissimum* var. *humile* and this has been further improved by hybridization.

1307. Bērziņš, E. 633.52:575.73:575.42
Linu dēģenerācija eksperimentālā apgaismojumā. (**An experimental study of the degeneration of flax for fibre**).
Rapp. X Congr. Sci. Agron. Riga 1936 : Pp. 20.

Comparative trials carried out on a large scale and for a long period shewed that the degeneration reported in flax grown for fibre was due to genetical impurity of the seed used.
It is shewn that the short stemmed plants are more prolific than the desirable long stemmed plants and that without rigid selection the short stemmed plants soon predominate. (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 702.)

1308. 633.522(47)
Sizov, I. A. 633.522:575
(Hemp in the U.S.S.R.). 633.522:577.81
Suppl. 76 Bull. Appl. Bot. Leningrad 1936 : Pp. 75.

This monograph deals with the morphological and biological nature of hemp in the U.S.S.R. The occurrence of racial differences between northern and southern forms in their vegetative period and reaction to length of day, in time of flowering and maturity, in stem and leaf structure and in rate of growth and germination is discussed in detail and mainly from the standpoint of the possibility of extending hemp cultivation further north in the U.S.S.R. Sex differences in flowering time and the nature of the sex phenomena in hemp are considered, as well as their more practical aspects such as pollination and pollen transference.

The suitability of the northern and southern races of hemp to various regions and latitudes is examined at some length with reference to their reactions to environmental factors. Attempts have been made to breed monoecious hemp and promising forms have been obtained. Though segregation is still occurring, it is hoped that constant forms may ultimately be secured. The author was unable to confirm the findings of other workers as to a correlation between the size and weight of seeds and the sex of the resulting plants.

Practical breeding should be directed to the production of forms with high yield and a good quality of fibre and of seed. The possibilities of the southern forms as material for the production of new types and for evolving varieties for the northern regions of the U.S.S.R. are pointed out. The value of wild forms too should be investigated.

Much space is devoted to describing the methods which should be used in hemp breeding, e.g. simultaneous mass selection of male and female lines; individual family selection; hybridization of distant geographical races; inbreeding accompanied by selection within the family (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 744). The latter method gives good results up to the I_2 or I_3, but not if carried further.

The importance of studying the biological and genetic features of forms used in hybridization is emphasized.

According to the author's observations, types with long stem internodes give a higher yield and quality of fibre and internode length is heritable. In crosses between southern and northern forms early ripening under northern conditions also proved heritable and dominant and tallness too was dominant to a considerable degree. Certain relationships between various characters of importance for selection have already been referred to in "Plant Breeding Abstracts", Vol. VI, Abst. 1296. Further investigations of such correlations are necessary.

The artificial induction of mutations is not recommended until further knowledge on the subject has been acquired. Hemp seed exhibits a considerable degree of resistance to X-rays. Vernalization of hemp seed for 30 days at from 0–10° C. produced no effect.

The results of trials of various populations obtained by selection in various regions are briefly recorded. Such populations frequently proved superior in yield to the local populations found at the centres where the trials were made.

In conclusion, the necessity for a proper organization of seed production is urged; the physical features and chemical composition of the hemp plant are discussed with reference to yield of fibre, sex differences being noted; and agronomic problems (including manuring and harvesting) and the pests and diseases of hemp are also considered. There is a bibliography of Russian and other references.

1309. Nevinnykh, V. A. 633.524.34:575.127.2
(On the hybrids between the species *Abutilon avicennae* Gaertn. and *Abutilon indicum* Sweet).
Priroda (Nature) 1936 : No. 10 : 99–103.

The desire to improve the fibre quality of *A. avicennae* led to attempts to cross it with a number of other species but only *A. indicum* flowered sufficiently early to obtain hybrids. Forty-nine flowers of *A. avicennae* were pollinated with this species, and sixteen hybrid fruits with a seed content varying between 11 and 43 were obtained. All fruits but one were hybrid.

The two species proved both to have the same chromosome number, 42. The F_1 plants

flowered earlier than either parent and continued flowering much longer; they were intermediate in most characters, but were highly sterile and gave no seeds on back-crossing with either parent. Late in the season some fruits developed parthenocarpically, some having 1 or 2 seeds. In all from 176 plants 185 normal seeds were obtained.
Further crosses were made on a larger scale in 1935, using nine different varieties of *A. avicennae* and from 1,217 crosses only 17 fruits with 327 seeds were obtained and from the reciprocal cross 12 fruits with 61 seeds from 1,491 crosses.

1310. Ocfemia, G. O. 633.526.1–2.8–1.521.6:575.127.2
Bunchy-top of abacá : its nature and control.
Circ. Coll. Agric. Philippines 1934 : No. 27 : Pp. 13.
No plants of abacá resistant to this virus disease have been found in the writer's material, which included plants raised by suckers, by seed and by varietal hybridization and there seems therefore little prospect of producing a resistant variety by selection. Since other *Musa* species are not attacked, inter-specific crosses may yield resistant hybrids.

1311. Calinisan, M. R. and
Hernandez, C. C. 633.526.1–2.8–1.521.6:575.42
Studies on the control of abacá bunchy-top with reference to varietal resistance.
Philipp. J. Agric. 1936 : **7** : 393–408.
The resistance to bunchy-top disease of a number of introduced varieties of abacá and of some surviving local varieties was tested. The introduced Putian variety shews definite resistance but of the local varieties none shewed permanent resistance.
The destruction of all diseased plants and the constant replanting of healthy ones is recommended for the control of the disease.

SUGAR PLANTS 633.6

1312. Guillaume, M. 633.61(59.7)
Monographie des variétés de canne à sucre de l'Indochine. (**Monograph of the varieties of sugar cane in Indo China**).
Bull. Econ. Indochine 1935 : **38** : 289–332, 478–518.
Part I contains the short introductory remarks and the review of previous work. Part II deals with the morphology of the cane, the analysis of the characters of pubescence and a study of the epidermis. The concluding chapter is a general biological study of the varieties. Part III, which has yet to appear, is to be concerned with the local varieties.

1313. 633.61:575
Mendiola, N. B. 633.61 C.A.C. 117
C.A.C. 117, a new sugar cane variety.
Sug. News 1937 : **18** : 46–47.
C.A.C. 117, a selected hybrid from the cross P.B. 119 x C.A.C. 87, is described. Compared with the two leading varieties P.S.A. 14 and P.O.J. 2878 it has given consistently favourable results. It appears to be resistant to diseases and pests.

1314. Abbott, E. V., Rands, R. D.
and Summers, E. M. 633.61–2–1.521.6:575·42(76.3)
Disease resistance and new seedling selection in 1936 at the U.S. Sugar Plant Field Station, Houma, La.
Sug. Bull., N.O. 1937 : **15**(14) : 3–7.
Three types of selection are made, namely, (1) "field" selections from the seedling nursery; (2) "primary" or pathological selections, chosen from the field selections after a red-rot test and sucrose analysis; these are assigned C.P. numbers; and (3) "agronomic" selections made from the primary selections after testing by agronomists.

In the present report details are given of the disease reactions of agronomic selections from the Canal Point, 1929, 1931, 1932 and 1933 series, the diseases considered being mosaic and red-rot. Further primary selections have been made from rattoons of the 1933 series.
Of the C.P. 1934 seedlings potted and raised at Houma (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1305), 4,463 or 92 per cent of the plant canes survived as rattoons. In the autumn of 1935, 658 field selections were made from the plant canes, of which 319 were increased following preliminary pathological and hand refractometer tests. Of these 33 received C.P. numbers in November 1936, four of which combined freedom from mosaic and commercial resistance to red-rot with early maturity. Further field selections were made from the rattoons in 1936.
Of the C.P. 1934 seedlings forwarded from Canal Point to Houma without a severe selection 49 have received C.P. numbers. Five of them free from mosaic and commercially resistant to red-rot have equalled or nearly equalled C.P. 28/19 in sucrose content.
Analyses of seedling families shewed the crosses C.P. 1165 x C.P. 27/108, C.P. 1165 x C.P. 28/44, Co. 281 x U.S. 1694 and C.P. 31/289 selfed to be outstanding among the 1933 series in respect of the number of primary selections they yielded. Among the 1934 series the crosses C.P. 29/307 x C.P. 29/252, U.S. 1643 x C.P. 29/284 and C.P. 28/11 x C.P. 27/38 were outstanding in respect of the number of field selections yielded.

1315. 633.61–2.111–1.521.6:575
BRANDES, E. W. 633.61–1.524.2(73 + 47)
Possibilities of further progress in breeding sugar cane for cold resistance.
Sug. Bull., N.O. 1937 : **15**(12) : 5–7.
Several hundred stools of *Saccharum spontaneum* from the Uzbekistan Soviet Socialist Republic have been grown in the open at Arlington Farm, near Washington D.C., during the past winter and, though the minimum temperature recorded was as low as 14° F., some stalks in every stool have survived.
It is hoped to use this cane in breeding for cold resistance, but the difficulty arises that, while tropical cane flowers in the short days of winter, this cane flowers in the long days of July. Two methods are to be used to overcome this, one involving sending arrows from Lima and the other controlling the light exposure of the cane to induce them to flower at the proper time. An expedition to the part of the U.S.S.R. from which the wild canes came is contemplated.

1316. ORLOVSKY, N. I. 633.63:575"793"
(Differentiation of beet varieties by their degrees of ripeness).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1936 : No. 3 : 54–75.
Maturity is shewn to be a complex concept, e.g. botanical maturity being the stage at which seeds are formed, biological maturity the stage at which the vegetative activity of the plant ceases in the first year and the disintegration products of the leaf migrate to the root, etc., etc., industrial maturity the stage at which the maximum sugar extraction is obtained, etc. Results show, however, that a given variety may be early in respect to one of these factors, or one element comprising it, and not in respect of others; and owing to the very specialized methods of breeding in the past, and the limited use of hybridization, the existing variation in these characters is extremely small. In breeding for these characters it is advisable to make periodical estimations of the yield, sugar content and juice quality of the different parental lines, to find when the maxima for these different factors occur; and hybridization is recommended between lines that are "biologically" early (though not necessarily high in yield or sugar content) and varieties known to be early in respect of these two latter factors, e.g. crosses of table or forage beets with extra early forms or wild early forms with cultivated, etc. The selection of a winter type suitable for harvesting at the end of summer or beginning of autumn is also recommended. For greater earliness it is necessary to make crosses on the phasic principle of Lysenko to combine the elements of earliness in the different developmental stages.

1317. 633.63:575.127.2:576.354.4
SEITZ, F. W. 633.63:576.356.5
Ein Beitrag zur Zytologie eines seltenen Rübenbastardes und einer seiner Rückkreuzungen. (**A contribution to the cytology of a rare beet hybrid and one of its back-crosses**).
Z. Wirtschaftsgr. Zuckerindustr. 1936 : **86** : 357–70.

A cross was made between *Beta trigyna* Waldst. et Hit. Descr. (n = 27) and the sugar beet (n = 9) and the F_1 was back-crossed with sugar beet. Somatic divisions were studied in the parents, F_1 and back-cross hybrid and meiotic divisions in the parents and F_1 hybrid. In the F_1 36 somatic chromosomes were found and in the back-cross progeny, 27.
At diakinesis in *B. trigyna* were found 27 bivalents, some rod-shaped and others ring-shaped. In the F_1 hybrid univalents, bivalents and one or two trivalents and quadrivalents were observed and at metaphase and anaphase of the first division precession and lagging of chromosomes occurred. Counts at interkinesis shewed that only rarely was the distribution of the chromosomes 18–18. Micronuclei occurred at this stage as a result of lagging chromosomes and the tetrads were often irregular. Suppression of the second division apparently occurred in some cases, for dyads were found. The pollen grains of the hybrid were round or oval and had the germ pores characteristic of the genus *Beta*; the frequency curve of their diameter was bimodal and they shewed a great range in size. The pollen appeared abundant and plump before the flowers opened, but at anthesis the anthers are crumpled and dried up and do not dehisce.
Further studies are to be performed, with special attention to the statistical aspects of the meiotic divisions.

1318. 633.63:581.143.26:575.42
CLAUS, E. 633.63:575"793"
Zur Züchtung einer schosserwiderstandsfähigen Zuckerrübe. (**Breeding a non-bolting sugar beet**).
Zuckerrübenbau 1937 : **19** : 54–61.

A further report on the author's selection of non-bolting strains by the use of autumn sowing and vernalization (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 247). Data are given on the percentages of bolters with spring sowing, shewing that the incidence of bolting had been greatly reduced, making early sowing possible, with the promise of increased yield.

1319. MILENKAYA, A. D. 633.63–1.563:575
(**Brief information on the estimation of sugar beet varieties as to their resistance to long storage in 1934-35**).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1936 : No. 3 : 100–02.

The loss in weight, sugar content and digestibility under prolonged keeping was examined in a number of new sugar beet selections. Some of the new strains shewed considerably less damage than the average, some of them losing only 3–5 per cent of sugar on keeping for periods of 150–200 days. Some of the new strains also suffered less from fungal attack during storage.

1320. ORLOV, P. G. 633.63–1.577:575
(**Science in the campaign for high yield in sugar beet**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 4 : 3–6.

Brief reference is made to the necessity for introducing early varieties with high yields and sugar content and also the need for new varieties and increased resistance to disease, as well as the production of varieties with uniform seed clusters—these aims to be pursued by means of intervarietal hybridization, using Lysenko's theory of phasic development. The yield of seed material from mother beets should be increased, winter forms should be produced and the study of the genetical and biochemical characters and of immunity should be intensively pursued. The extension of beet cultivation into new regions is also emphasized.

1321. DAVEY, A. E. 633.63–2.484–1.521.6
Nitrogen supply of sugar beets in sand cultures in relation to extent of injury by southern *Sclerotium* rot.
Phytopathology 1937 : **27** : 126–27. (Abst.)
Attempts were made to test the resistance or susceptibility of sugar beets to *Sclerotium rolfsii* by growing the plants in culture solution and varying the supply of nitrogen. In general the plants with low nitrogen suffered from permanent wilting in a shorter time after heavy inoculation than those with a high nitrogen supply.

1322. SMITH, B. W. 633.685:576.312.35:576.312.332
Notes on the cytology and distribution of the Dioscoraceae.
Bull. Torrey Bot. Cl. 1937 : **64** : 189–97.
The somatic chromosome numbers of 13 species of *Dioscorea* are given. They range from 20 to 144, with a strong tendency to form multiples of 10. Hetero-chromosomes found in certain species are considered to represent sex chromosomes.

STIMULANTS 633.7

1323. 633.71:575.11.061.6:575.116.1–181
SMITH, H. H. 633.71:575.127.2
The relation between genes affecting size and color in certain species of *Nicotiana*.
Genetics 1937 : **22** : 361–75.
In the cross *N. Langsdorffii* x *N. Sanderae* (Sutton's Scarlet) the linkage of genes affecting corolla size with genes affecting corolla colour and other qualitative characters (Cf. Abst. 1324) was studied by comparing flowers belonging to different classes with respect to the qualitative factors. The index of size used was 1,000 x (log tube length + log maximum lobe length).
The corolla of *N. Sanderae* is much larger than that of *N. Langsdorffii* and the genes contributed by *N. Sanderae* for corolla colour, pollen colour and for self-sterility were found to be associated with factors for increased size. The average size differences associated with given factors diminished in later generations, indicating crossing-over between the qualitative and quantitative factors.
There were apparently many size genes involved with effects of comparable magnitude, the symmetry of the F_2 distribution indicating that there was none with major effects. Some could be shewn to be incompletely dominant and by comparing suitable series of classes it was shewn that their effects are cumulative. No consistent type of interaction was found.

1324. SMITH, H. H. 633.71:575.11.061.6:575.127.2
Inheritance of corolla color in the cross *Nicotiana Langsdorffii* by *N. Sanderae*.
Genetics 1937 : **22** : 347–60.
The inheritance of factors affecting corolla colour was studied in the cross *N. Langsdorffii* x *N. Sanderae* (Sutton's Scarlet). The cross could not be made in the opposite direction. Both species have nine haploid chromosomes.
The gene *P*, contributed by *N. Sanderae*, permits the development of anthocyanin colour on the inner surface of the corolla while two extension factors *E*1 and *E*2, also from *N. Sanderae*, govern the extension of colour to the outer surface; *E*1 and *E*2 are independent and only double recessives have restricted distribution of colour.
Two dominant, independent, cumulative genes *I*1 and *I*2 cause increases in colour intensity. *P* has a minor lightening effect when heterozygous and a fourth gene *D* from *N. Langsdorffii* has a diluting effect.
The red colour of *N. Sanderae* is conditioned by *R*, the recessive *r* being purple.
The abundant chlorophyll pigmentation of the corolla in *N. Langsdorffii* is produced by a single main dominant gene *G* and there is evidence that two complementary modifying factors *Y*1 and *Y*2 may also be operating.
The sporophytic character blue pollen in *N. Langsdorffii* is caused by complementary factors *B*1 and *B*2.

The presence of linkage between *B*1 and the self-sterility locus (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 578) was confirmed and associations indicating possible linkages were observed between pollen colour and intensity of corolla colour, between extension and intensity and between *P* and a chlorophyll modifier.
A superficial examination of meiosis in the F_1 indicated that the characteristic configuration at first metaphase was six bivalents, two lagging univalents and an association of four chromosomes. The F_1 had 50 per cent aborted pollen and the percentage of aborted pollen in F_2 ranged from 1 to 75. The segregation of the factor *G* was affected by the percentage of aborted pollen, suggesting that the chromosome on which it is located pairs in an irregular manner.

1325. Smith, H. H. 633.71:575.115–181.13:576.356.4
"Reversal of dominance" in crosses between *Nicotiana rustica* and *N. tabacum*.
Genetica 1937 : **22** : p. 209. (Abst.)
Indeterminate or mammoth growth habit in *N. Tabacum* is a recessive character controlled by a single main gene. Mammoth plants were crossed with five different plants with the ancestry "[(*rustica* var. *pumila* x *Tabacum*, not mammoth) x *rustica* var. *brasilia*] selfed". From four of these plants only determinate F_1 plants were obtained but in the F_1 from the fifth 10 out of 76 individuals were mammoth. Lagging univalents were observed at the reduction division in all the five segregates and this apparent reversal of dominance is considered to be due to the loss of the chromosome bearing the normal allelomorph of mammoth.

1326. Kostoff, D. 633.71:575.127.2:576.356.5
Studies on polyploid plants. XVII. *Nicotiana multivalvis* (2n = 48) x *N. suaveolens* (2n = 32) amphidiploid (2n = 80).
C.R. (Doklady) Acad. Sci. U.R.S.S. 1937 : **XIV** : 215–17.
The amphidiploid of the cross in question was induced by growing the hybrid plants at high temperatures for short periods each day.
The reduction division was quite regular and the progeny was uniform and resembled the F_1 hybrids. About 88 per cent of viable pollen was formed.

1327. Kostoff, D. 633.71:575.127.2:576.356.5:578.088.2
Studies on polyploid plants. XVI. *Nicotiana rustica* x *Nicotiana Tabacum* amphidiploid.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1937 : **XIV** : 453–55.
A fertile branch, with the doubled chromosome number 96, was produced by centrifuging the seedlings of the sterile hybrid of *N. rustica* x *N. Tabacum*. In the first meiotic division univalents, trivalents and one quadrivalent were observed. By selfing the fertile branch, fertile, partially fertile and sterile plants were produced.

1328. Paguirigan, D. B., Ramos, J. C. and Gopez, F. Y. 633.71:575.42
On the effect of continuous selection upon tobacco; a progress report.
Philipp. J. Agric. 1936 : **7** : 379–92.
The effect was studied of continuous selection on breadth index of the leaves, the height of the plants, the number of standard leaves and the average yield per hectare. In some cases the experiments were carried out over a ten year period.
There was no significant effect on the mean of the breadth index of the leaves. The height of the plants in general was not increased by continuous selection. The number of standard leaves was not increased by selection. Continuous selection appeared to have a favourable effect upon yield but as these results were only for two seasons, they are not held to be conclusive.
Standard deviation and coefficient of variability were directly proportional to the range of variation of the characters studied.

1329. Pratasenja, G. D. 633.71:576.356.5:581:581.165
Production of polyploid plants after regeneration. II. Autotetraploid of *N. glauca*.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1937 : **XIV** : 449–51.
An autotetraploid plant (2n = 48) of *N. glauca* was obtained by regeneration from a leaf cut off at the base of the petiole.

1330. Levine, M. 633.71–2.3:575
Crown gall on *Nicotiana glauca* and *Nicotiana langsdorffii* and the spontaneous "tumors" of their hybrid.
Phytopathology 1937 : **27** : p. 134. (Abst.).
Differences in response to the tumour-producing activity of *Bacterium tumefaciens* were noted in *Nicotiana glauca* and *N. Langsdorffii*. Studies were made of the spontaneous tumour-like structures on the stems of roots of the hybrid of these two species. Though somewhat resembling crown gall macroscopically, they shewed microscopical differences.

1331. 633.71–2.8:575.11
Holmes, F. O. 633.84–2.8:575.11
Hereditary factors affecting tobacco-mosaic disease in solanaceous plants.
Phytopathology 1937 : **27** : 131–32. (Abst.)
Further information is provided on the behaviour of the genes associated with the response to infection with tobacco mosaic disease in *Capsicum*, *Browallia* and *Nicotiana* (See also Abst. 1332).

1332. Holmes, F. O. 633.71–2.8–1.521.6:575.127.2
Genes affecting response of *Nicotiana tabacum* hybrids to tobacco-mosaic virus.
Science 1937 : **85** : 104–05.
The gene controlling necrotic type of response (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 974) has been transferred from the *N. paniculata* derivative to plants of [(*N. paniculata* x *N. Tabacum*) x *N. Tabacum*] x *N. Tabacum*. In the back-cross generations there were considerable deviations from 1 : 1 ratios of necrotic type to mottling type.
A similar transference has been made of a gene for necrotic response from *N. glutinosa* to three generations of hybrids with *N. Tabacum*. All the F_1 hybrids gave a necrotic type response and all were sterile and further transference was accomplished only by the use of *N. digluta*.
Work on the transference of a similar gene to *N. Tabacum* is in progress.

1333. Katar'jan, T. G. 633.72:575
(Tea breeding).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 9 : 24–27.
Under the conditions of the tea regions of the Soviet Union it has been found possible to self-pollinate tea plants; the progeny is mainly of the parental type but there is always the possibility of obtaining recessive segregates, such as forms possessed of resistance to cold or to diseases. Hybrid seedlings have also been produced and these generally excel the selfed seedlings in vigour and also those obtained by free pollination. They were also better in quality of the plant. In crosses between northern and southern types the northern forms made the best maternal parents.

1334. Ferwerda, F. P. 633.73:581.162.3
Enkele waarnemingen over de bestuiving van koffie. (**Some observations on the pollination of coffee**).
Arch. Koffiecult. Ned.-Ind. 1936 : **10** : 32–41.

Pollen transference by insects is very restricted and cross-pollination is effected mainly by the wind. Experiments were made on level ground to determine how far and in what amounts coffee pollen can be carried and what factors affect its transference adversely or otherwise. It was found that, considering various ranges from 1·5 to 100 metres, the greatest quantity of pollen was carried to a distance of 5 metres. Considerable quantities were also found at a height of 8 metres from the ground at 6 metres range. From the fact that very little was carried to a distance of 1·5 metres it is concluded that the wind carries it upwards first. From the data obtained, a coffee tree with an assumed area of 5 square metres and producing from 10 to 30 thousand flowers should receive 2½ million grains of pollen at a distance of 8 metres in 8 hours, which should amply provide for pollination.
The findings at Bangelan indicate that a border of 15-30 metres is required in monoclone plantations if cross-pollination is to be prevented.
The question of pollen transference in between the trees or over their tops was also investigated as well as the effect of bushy green manures in preventing transference.
As regards the conditions for self-pollination it was estimated that the amount of pollen falling vertically from a tree was approximately 3 million grains in 8 hours over an area of 9 square metres.

AROMATIC PLANTS 633.8

1335. Urinson, R. 633.812:575.242:581.192
(**Studies on the chemical composition of the essential oils of mutants of the geranium *Pelargonium roseum* Hort.**).
Bull. Appl. Bot. Leningrad 1936 : Ser. III (13) : 67–85.

Investigations were made on the amount, composition and physical constants of the oil obtained from a number of geranium varieties, including several vegetative mutants. The results clearly shewed that not all mutations of a morphological character have a corresponding effect on the chemical processes of the plant. Some mutants do, however, differ in the rate of production of different components of the oil, thus altering their proportions in the final product; some of the vegetative mutants examined differed in the alcohol content of the oil. Some mutants of *P. roseum* contained stearoptene, a compound characteristic of *P. graveolens*, one of the putative ancestors of the species. One of the mutants, while being equal to the best cultivated varieties in yield and essential oil content, was superior in the citronellal content of the oil, which greatly increases its quality.

1336. Pravdolubova, A. 633.812:581.192:575.12
[**On the composition of the essential oil of *Pelargonium capitatum* No. 24 and *Pelargonium radula* No. 29. (On the question of chemical variability due to hybridization).**]
Bull. Appl. Bot. Leningrad 1936 : Ser. III (13) : 87–89.

A plant of *P. capitatum* examined in 1932 contained 80 per cent of decylic acid in the oil, a compound not found in any other known variety of this genus. The plant in question was a hybrid and decylic acid was later found in another hybrid plant, leading to the conclusion that hybridization may give rise to an entirely new compound in this way.

1337. Nelson, R. 633.822–2.484–1.521.6:575
Verticillium wilt of peppermint.
Phytopathology 1937 : **27** : p. 137. (Abst.)

The symptoms of a serious wilt of peppermint are described. English and American peppermint varieties are very susceptible but resistance was found in some of the spearmints. Attempts are being made to breed resistant forms.

1338. 633.854.78(47)

MINKEVIČ, I. A. 633.854.78:575(47)

(Varieties of sunflower and their regions of distribution in the U.S.S.R.).

Vsesojuznaja Akademija Sel'skokhozjaistvennykh Nauk im. V.I. Lenina, Vsesojuznyi Institut Rastenievodstva. Gossortoset (Lenin Academy of Agricultural Sciences, Institute of Plant Industry, Variety Testing Service) Leningrad **1936** : Pp. 224.

This monograph deals with the sunflower and its cultivation in the U.S.S.R. from a great many different angles. After discussing the importance of sunflower as a crop and describing the methods of cultivating it, the methods of variety testing and their objects are elaborated. Discussions follow upon the range of variation among the existing varieties in respect of such characters as time of maturity, resistance to disease and to the dreaded *Orobanche*, oil content, size of seed, and morphological characteristics such as branching, height, etc.

The results of tests of a number of varieties in various regions of the U.S.S.R. are reported in detail, after which a brief description is given of the best varieties produced by breeding, with indications of their origin and their main defects. The first requirement in breeding improved varieties is that they should be sufficiently early in maturity, to permit of their being grown in the north and east; varieties for the north should ripen in the first three weeks of August, those for the south at the end of August or beginning of September. Of equal importance is drought resistance, since sunflowers have to grow in very arid zones in the south-east; the variety Saratov 169 is the only one at present in cultivation which is sufficiently drought-resistant. The production of sufficiently early forms is another way of avoiding the effects of drought. The next point in importance is resistance to *Orobanche cumana* and to a variety of fungous diseases and pests; varieties resistant to race B of *Orobanche* have already been produced. A form of plant suitable for mechanical harvesting is also desirable, an unbranched habit being, among other things, important in this connexion, and freedom from shedding is equally desirable. Combined with all these should be the most important factor of all—a high yield of oil per hectare and the quality of the oil should also not be neglected.

1339. 633.854.78:575(47)

ŽDANOV, L. A. 633.85:575.42(47)

(The breeding of sunflowers and other oil-bearing crops).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) **1936** : No. **11** : **17–18.**

The early resistant forms were resistant only to race A of *Orobanche cumana*. Further investigations have revealed a certain resistance to race B in some forms of cultivated sunflower and in a number of other species of *Helianthus*. By selection in diseased ground, cultivated varieties possessed of high degrees of resistance to both forms have been isolated and these are not inferior to the standard varieties in oil content and earliness, and further breeding work is in progress to improve their rust resistance, yield and other qualities. In crosses with susceptible varieties resistance is shewn to be almost fully dominant.

Selection has also been carried out in other oil plants; including linseed, castor oil, safflower and sesame.

1340. GARROS and RANCOULE. 633.855.34:575.42(67.5)

Projet de sélection du palmier à huile commun aux stations de La Mé et Pobé. **(Scheme for the selection of the oil palm for the stations of La Mé and Pobé).**

Bull. Inst. Colon. Marseille. Mat. Grasses **1937** : **21** : **41–46, 57–63.**

A basis for the selection of suitable trees grown at the two stations of La Mé and Pobé is outlined.

In the second part of the paper the suggestions of M. Beirnaert, Director of the Yangambi Station, on the possibilities of improving the existing types are discussed.

1341. Portères, R. 633.855.34:575.42(67.5)
Comparaison entre le palmier de Yangambi et ceux de La Mé et de Pobé. (**A comparison of the palms of Yangambi and those of La Mé and Pobé**).
Bull. Inst. Colon. Marseille. Mat. Grasses 1937 : **21** : p. 63.

Note de M. R. Codé, Ingenieur en chef, chef du service de l'agriculture P.I. de la côte d'Ivoire sur le rapport de M. Garros. (**A note of M. R. Codé, on the report of M. Garros**).
Bull. Inst. Colon. Marseille. Mat. Grasses 1937 : **21** : 66–67.
Notes on the preceding article especially criticizing the formula for selection proposed by M. Houard and discussed by MM. Garros and Rancoule.

RUBBER PLANTS 633.91

1342. Schmöle, J. F. 633.912:575.42:578.08
Over het effect van selectie op kweekbedden met behulp van een tapmesje volgens patent van Dr. P. J. S. Cramer (Testatex mesje). [**On the effect of selection in nursery-beds by means of a tap-knife according to Dr. P. J. S. Cramer's patent (Testatex knife)**].
Arch. Rubbercult. Ned.-Ind. 1936 : **20** : 120–29.
Test tappings of seedlings derived from certain Avros clone numbers, mainly by outpollination, shewed that, for seedlings with the yield capacity and variability of those studied, selection in the nursery by means of the "Testatex" tapping knife would result in the rejection of about two-thirds of the plants on the basis of yield. The remaining third, if retained, would have an average yield about 17 per cent higher than if the selection had not been carried out.

1343. Poletika, W. v. 633.913(47)
Kautschukliefernde Pflanzen in Russland. (**Rubber-producing plants in Russia**).
Forschungsdienst 1937 : **3** : 200–07.
A brief account of the cultivation and value of the plants being utilized for the production of rubber and gutta-percha in the U.S.S.R. (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 754).

FRUIT TREES 634

1344. Rubtzov, G. A. 634:575
(**Scientific basis of fruit tree breeding**).
Suppl. 78 Bull. Appl. Bot. Leningrad 1936 : Pp. 124.
The history and present position of fruit breeding in various countries including the U.S.S.R. are outlined. Michurin's experiments as well as the production by other workers of cold-resistant apples by crosses with the local Siberian form *Malus baccata* receive due notice as do also the developments in the use of distant hybridization, inbreeding and ecological studies of initial plant material for selection. An outline is given of the various resources of the U.S.S.R. with its numerous and widely distributed varieties and types of fruits and nuts, special attention being directed to the wide range of variation in the *Pomaceae* and the *Drupaceae*.
The uses of hybridization, chromosome aberrations, mutations and modifications of various kinds are pointed out with reference to the breeding of fruits and nuts, and hybridization, sterility and fertility are discussed with examples from well-known workers. The role of the chromosomes and the significance of cytology in the production of new forms and in elucidating sterility and constancy of hybrids from distant crosses are indicated. Having defined Mendelism and the different types of factors with reference to practical applications in the production of new forms the author then considers the selection of parents for crosses, inbreeding, xenia, parthenocarpy, and apogamy as well as the horticultural characteristics of fruit and nut trees and the difficulties they present in genetic analysis.

The main trends in fruit breeding are directed towards ensuring high quality and ecological adaptation, earliness, high and reliable yield and resistance to cold, drought and disease. Various methods of breeding and their suitability to the different types of fruit trees are mentioned and emphasis is laid on the utilization of the enormous existing variety of forms and on the use of wild forms and distant crosses. A brief section touching upon basic principles of selection, the raising of seedlings, the organization of the breeding of fruit and nut trees and the need for attention to the genetic, physiological, biochemical and immunological aspects of such work precedes summaries of the findings of various workers on the apple, pear, peach and almond and species of *Cydonia, Sorbus, Cerasus, Prunus* and various nut trees such as the walnut, pecan and chestnut. The individual fruits and nuts are considered from the point of view of their various forms with any available data on their cytology, fertility and yield and with some observations on the most useful varieties for the conditions in the U.S.S.R. and the most desirable aims in breeding for such conditions. Mention is also made of a number of interspecific and intergeneric hybrids that have been obtained.
A nine-page bibliography of relevant papers in English, Russian and other foreign languages concludes the monograph.

1345. Spirin, V. V. 634:575(47)
(Breeding berry fruits in the north).
Za Mičurinskoe Plodovodstvo (Horticulture by Michurin's methods. Bull. Lenin Acad. Agric., Sci. Res. Inst. Fruit Grow. I. V. Michurin) 1936 : No. 5 : 45–48.

Brief descriptions are given of a number of varieties of gooseberry, raspberry, currants and apple produced by the author by the application of Michurin's principles; hardiness, yield, flavour and size of fruit being the points to which attention has been given.

1346. Bakharev, A. N. 634:575.127
(Standard varieties of stone fruits).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 7 : 4–7.

The Ideal cherry, Michurin's hybrid between *Prunus chamaccerasus* Sacq. and *P. pennsylvanica*, closely resembles the former parent in its extreme hardiness, and crosses well with the sweet cherries; it is a valuable starting point therefore for combining the qualities of these species with the hardiness of *P. chamaccerasus*. By pollinating Ideal with a mixture of pollen from Knight's cherry and Early Cassinia a greater success (11 per cent) was obtained than by using pollen of either of these forms alone. Several hardy sweet cherries have been produced by this method. Among the second generation seedlings from Michurin's hybrids valuable forms have also been found, e.g. a sour cherry with fruits weighing up to 8 grm. and of good dessert quality.
With plums, too, crosses have been made between the Michurin hybrids and southern varieties. To produce varieties coming early into bearing use has also been made of *Prunus Besseyi* in crossing and hybrids of *P. Besseyi* x *P. triflora* have also been produced. These bore fruit in the third year but it was small and Michurin's "mentor" method was applied, namely grafting a scion of *P. triflora* on the top of the hybrids.
Michurin's apricot hybrids have also been crossed with southern varieties and promising hardy seedlings of good quality of fruit have been obtained. Crosses have also been made between the southern varieties and *Armeniaca mandshurica* and also with various plum hybrids, the latter with the object of producing apricots that flower later so as to avoid spring frosts. In the first generation of a cross *P. Besseyi* x apricot segregation was observed, some hybrids resembling one parent and some the other.
Crossing on similar lines has been carried out with success in peaches by using natural peach-almond hybrids and Michurin's "Porrednik", (*Amygdalus nana* Monhdica x *A. Davidiana*).

1347. Issayev, S. I. 634:575.127
(The late I. V. Michurin's methods as the basis of plant-breeding work).
Za Mičurinskoe Plodovodstvo (Horticulture by Michurin's methods. Bull. Lenin Acad. Agric., Sci. Res. Inst. Fruit Grow. I. V. Michurin) 1936 : No. 4 : 7–15.

The author resents the statements of certain other writers that Michurin has contributed little to genetical science and quotes experiments of N. N. Tikhonov where by using Michurin's methods hybrids have for the first time been raised between *Cerasus Besseyi* and the Chinese species *C. tomentosa*, the hybrids being superior to the parents in resistance to cold and disease; also hybrids of *C. Besseyi* x *Prunus triflora* characterized by great hardiness and extremely early bearing. The writer refers to many of Michurin's favourite principles, and particularly to the influence that a breeder may have upon a young seedling through the conditions under which it is raised. The methods of other workers are rejected on the score that they are not in agreement with Michurin's principles.

From seedlings of some of Michurin's varieties valuable new forms have been obtained, e.g. combining the flavour of the southern with the hardiness of the northern apples and similar achievements in other fruits.

Michurin's greatest contribution to plant breeding was his use of exhaustive collections of the local forms from all parts of the world, the forms so found being in some cases used for direct introduction, in others for breeding. An extension of this work is greatly to be desired, especially as regards world forms, and this question is receiving particular attention at the Michurin Research Institute. In crossing great care is given to the choice of parents, according to Michurin's principles, and large numbers of seedlings are raised (e.g. in apple crosses over 500). Existing hybrids are often used as parents, to increase the segregation.

It is shewn how the collective farms can help in carrying on this work on a mass scale.

1348. 634:575.127
Petrov, A. V. 634:581.331.2.037
(Methods of distant hybridization of fruit crops).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 5 : 18–20.

Michurin's early work on apples and his later achievements in producing cold and disease resistant plums, cherries, berry fruits, etc. are outlined, with a note on his strawberry crosses and Lichovitzer's subsequent cytological findings in these hybrids (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 1110). Michurin's technique for the hybridization of distant species and the results he obtained with rowan and pear crosses (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 1106) are referred to as well as his finding that "ionization" of pollen raised the percentage of functional ovaries from 1·9 per cent for the controls to 7·9 in a rowan x pear cross. (Cf. also "Plant Breeding Abstracts", Vol. VII, p. 122).

1349. Lisitsyn, N. V. 634:575.127(47)
(Make use of Michurin's legacy).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 7 : 1–3.

An appreciation of Michurin's work on plant development and on the hybridization of distant species and genera to produce new forms suitable for the various regions of the U.S.S.R. General co-operation is called for in continuing this work by introducing Michurin's productions into industry and by forming collections of selected standard varieties of the new forms and of valuable local types, too, for the various districts.

1350. 634:575.127:581.331.2
634.71:575.127.2

MICHURIN, I. V.
(Pollination with mixed pollen).
Za Mičurinskoe Plodovodstvo (Horticulture by Michurin's methods. Bull. Lenin Acad. Agric., Sci. Res. Inst. Fruit Grow. I. V. Michurin) 1936 : No. 5 : 3–4.

In cases where two species or genera are very difficult to cross, the author is of the opinion that the scent of the foreign pollen is an obstacle to fertilization. By placing a small amount of this pollen in a larger quantity of maternal pollen, the foreign pollen partially acquires the scent of the latter and successful pollinations have been made by this means. If larger quantities of the foreign pollen are available this is simply mixed with three times as much maternal pollen and the mixture is applied; by this means hybrids have been found among the seedlings, e.g. in a cross of *Rubus xanthocarpus chinensis rugosa* x *R. fruticosus*.

1351. 634.11:575
634.22:575
634.11 Beacon
634.22 Ember

ALDERMAN, W. H.
New Minnesota fruits named.
Minn. Hort. 1936 : **64** : No. 2 : 23–24.

The Beacon apple was selected from a number of seedlings of the Malinda apple and may be the product of cross-pollination with another variety of apple or with a crab apple. Although a late variety the Beacon has shewn itself to be markedly superior to the other late varieties grown in Minnesota. The Ember plum is a hybrid between the Shiro plum and an unnamed variety. It is late maturing and high-yielding and the fruit is of high quality.

1352. 634.11:575(47)
634.11:575.127.2

ŽAVORONKOV, P. A.
(Methods of selecting winter-hardy apples).
Za Mičurinskoe Plodovodstvo (Horticulture by Michurin's methods. Bull. Lenin Acad. Agric., Sci. Res. Inst. Fruit Grow. I. V. Michurin) 1936 : No. 5 : 19–29.

As breeding material for the production of extremely hardy apples the Siberian crab, *Malus baccata*, is the most promising, since it tolerates temperatures of – 60° C.; it also comes very early into bearing, flowers early, fruits abundantly and is highly disease resistant; its defects are smallness of fruit which, however, varies from 1·5 to 2·5 cm. in diameter; the fruit has a turpentine flavour and coarse flesh. Michurin used this species in the production of some of his hardy hybrids, e.g. Taežnoe (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1039) and this variety is recommended for use as a parent. *M. baccata* has also been used in the U.S.A. in breeding hardy apples, where some of its seedlings have given rise to improved varieties, being apparently natural hybrids.

Some of the hybrids in the first, second and third generations of these crosses have equalled the wild parent in hardiness; the proportion of them falls rapidly with each back-cross with the cultivated apple, two at least of which are necessary to restore the fruit size. The fruit quality also varies in the hybrids.

For breeding varieties suited to the excessively cold climate of the Urals and Siberia it is thought desirable to take as maternal parents the Siberian crabs with the largest fruits and highest frost-resistance, or hybrids of these with cultivated varieties and also the local "semi-cultivated" forms. As pollen parent cultivated varieties with the best fruit qualities from warmer regions should be taken, full use being made of existing Michurin hybrids. Crosses of this type were made in 1934 and 5,300 seedlings were obtained. Most of them had not shed their leaves by the beginning of winter, whilst seedlings of the Siberian crab did; this shews that the short vegetation period of the crab type is not fully dominant. The number of seedlings of short vegetation period was greater when the pollen parent was an early form from central Russia than when it was one of the southern forms. The leaf characters were also different in the seedlings from different pollen parents.

Further, more varied crosses were made in 1935 and 8,000 seedlings obtained. The desirability of finding some means, such as vernalization, for accelerating bearing on the young seedlings is emphasized.

1353. 634.11:575(73)
SCHRADER, A. L. 634.11:575.252.061.6
Trends in new apple varieties.
Trans. Peninsula Hort. Soc. 1936 : **26** : 88–91.

A brief survey of some recently introduced varieties of apples and of their qualities. Several red strains of standard varieties are also mentioned.

1354. 634.11:576.354.4:576.356.5
634.11:581.162.5:575.113.7
HEILBORN, O. 634.11:581.6
Reduction division, pollen lethality and polyploidy in apples.
Acta Hort. Berg. 1935 : **11** : 129–84.

A discussion of these problems based on the literature and on the author's own work.
All apple varieties are either diploids or triploids, about 80 per cent being diploids. Meiosis in diploids is usually regular, though univalents sometimes are found and rarely quadrivalents. The frequency of univalents may be increased by high temperatures. The results of Darlington and Moffett on secondary pairing were confirmed, indicating that the apple is a trebly hexasomic tetraploid on a base number 7, the formula of the haploid set being *AAABBBCCCDDEEFFGG*.
Meiosis in triploids is much less regular, quadrivalents, trivalents, bivalents and univalents being found. The author has seen no higher associations than quadrivalents. The number of trivalents which can be formed indicates that the triploids are autotriploids.
Extensive data are presented on pollen lethality in diploid varieties. These may be divided into four classes, *A* with fully fertile pollen, *B* with $\frac{1}{8}$ abortive, *C* with $\frac{1}{4}$ abortive and *D* with about 35 per cent $(\frac{11}{32})$ abortive. A scheme to explain these in terms of pollen lethals is presented, the lethals being probably deficiencies. Two sets are concerned, a_1, a_2 and a_3 in the *A* chromosomes and d_1 and d_2 in the *D* chromosomes. Pollen grains carrying $a_1a_2a_3$ or d_1d_2 are non-viable. The same scheme may apply to triploid varieties, but here the meiotic irregularities have also to be considered. The amount of abortive pollen can also be increased by high temperatures, especially in class *B*.
It is shewn that there is a general connexion between the degree of polyploidy and keeping quality, triploids being all capable of long or fairly long storage.

1355. MALENOTTI, E. 634.11–2.7–1.521.6
Una varietà di melo resistente alla tignola. (**A variety of apple resistant to the apple moth**).
Atti Accad. Verona 1934 : **11** : Ser. V : 51–56.

In 1931 and 1932 the apple trees of the Lèssini district in Italy suffered severe damage from the attacks of the larvae of *Hyponomeuta padellus* L.
A resistant variety, named Cavazzese, is described which appears to owe its immunity to its late development. The larvae hatch out but die from lack of food.
Grafting the resistant variety is recommended as a control measure.

1356. 634.13:575
634.12:575
634.13 Parker
ALDERMAN, W. H. 634.12 Flame
New Minnesota fruits.
Minn. Hort. 1934 : February, pp. 25 and 28.

The Parker pear was grown from seed collected from a Manchurian orchard and is possibly a hybrid between *Pyrus communis* and *P. ussuriensis*. It is very winter-hardy with good quality fruit.
The Flame crab apple, of unknown origin, though recommended in the first place for ornamental purposes has fruits of excellent quality for jelly making.

1357. GORCZYŃSKI, T. 634.13:576.354.4
Badania cytologiczne nad zmiennością dzikiej gruszy. (*Pirus communis* L.). I. Chromozomy w trakcie podziałów komórek macierzystych pyłku. (**Cytological investigations on the variability of *P. communis* L. I. The chromosomes during the division of the pollen mother cells**).
Roczn. Nauk Ogrodniczych (Ann. Sci. Hort.) Warsaw 1936 : **3** : 163–96.

Meiosis was studied in the pollen mother cells of ten series of wild pear trees from the neighbourhood of Puławy, in the hope of throwing some light on the marked variability observed in *P. communis*.

It was found that the chromosome number was variable, between different limits in the different series. The number of "bivalents" at diakinesis varied from 15 to 22. The morphology of the chromosomes also varied. At diakinesis univalents, bivalents and multivalents occurred. In the cases where multivalents occurred, secondary associations appeared at metaphase, but not in all series.

1358. HILDEBRAND, E. M. and HSIONG, S. L. 634.13–2.3–1.521.6:575
Inheritance of plant characters and resistance to fire blight in pear.
Phytopathology 1937 : **27** : p. 131. (Abst.)

A study of the inheritance of plant characters in standard pear varieties and their F_1 hybrids shewed that the maternal parent as a rule exerted the more important influence on the progeny. The transmission of blight resistance as measured by the percentage of positive inoculation and length of blight lesion produced, was found to be correlated with certain plant characters in the more resistant varieties Kieffer and Seckel.

1359. MATHER, K. 634.2:576.354.4:576.356.5
Notes on the cytology of some *Prunus* species.
Genetica 1937 : **19** : 143–52.

In nine seedlings of *P. cerasifera* from the Caucasus 2n = 16 was found in the root tips. Meiosis was examined in three other plants of this species, in one of which eight bivalents were formed regularly. The other two plants formed seven bivalents and two univalents in several nuclei and this led in certain cases to the formation of a restitution nucleus and the failure of reduction.

Chromosome counts were made of Caucasian seedling plants of *P. spinosa* and a polyploid series was found within this species, 2n = 16, 24, 40 and 48 being recorded.

All the forms of *P. institia* and *P. domestica* examined were hexaploid (2n = 48). At meiosis multivalent formation was observed to varying extents in the varieties of *P. domestica* and in the variety "mirabelle", which is sometimes regarded as a form of *P. institia*. In *P. institia* itself, however, no multivalents were seen. Univalents were found in all these forms. No secondary pairing was observed at metaphase.

The chromosome numbers of some plum seedlings were counted and though no aneuploid forms were encountered, two had approximately 72 chromosomes.

The repeated occurrence of unreduced gametes or their consequences in this section of the genus affords support for the hypothesis that the plum arose from a cross between *P. cerasifera* and *P. spinosa* (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 764).

1360. 634.22:575
634.722:575
634.22 Superior
ALDERMAN, W. H. 634.722 Red Lake
Fruit growers' problems. New fruits named—Superior plum-Red Lake currant.
Minn. Hort. 1933 : January, p. 13.

Superior, a plum from the cross Burbank (*Prunus salicina*) x Kaga (*P. americana* x *P. Simonii*) is therefore a three species hybrid. It is outstanding for vigour, yield and for the size and quality of its fruit.

The currant, Red Lake was selected from seedlings of unknown parentage. It is late and high yielding, equal and in some respects superior to Perfection.

634.22:575.127.2:634.23(5)

1361. Tikhonov, N. N. 634.23:575

(The improvement of stone fruits in the Far Eastern Area).

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 4 : 29–31.

The following methods are being used to improve the fruit of the Far Eastern Area: (1) the collection of local material and selection from it, (2) introduction of suitable species, (3) selective breeding and (4) hybridization. Over 150 forms of *Prunus triflora* and *P. ussuriensis* and several score of cherry forms have been collected by expeditions during 1928–34. Most of the varieties obtained from Northern Manchuria are completely frost resistant and from them very useful forms for the Far Eastern Area were selected. The American forms, which are not frost resistant enough, are being used mainly as initial material for breeding.

The hybrids that have been produced are mainly from local species crossed with American and Chinese forms—European species having been little used owing to the difficulty with which they cross with Far Eastern forms.

The work is not yet finished but some success has already been attained by providing earlier and later forms (and thereby extending the plum season in the Far Eastern Area) and by increasing the keeping and transport qualities as in the hybrid Krasnaja No. 389 x shiro, which is also declared to be free from attack by *Rhodoseptoria ussuriensis* which reduces the yield from all the local varieties. Some of the varieties recommended for the Far Eastern Area are mentioned.

Selection in *Cerasus tomentosa* has resulted in the production of cherries with improved frost resistance and good yielding capacity and, in two varieties, also large fruits. The Japanese cherry has been crossed with *Cerasus humilis* to obtain a fruit that is edible in the fresh state and produces jam of nearly as good quality as that made from the European cherry. In frost resistance too these hybrids are superior.

Hybrids between *C. Besseyi* and *P. ussuriensis* are regarded as of value on account of their habit of early bearing, one year old trees flowering freely and fruiting. Several also proved remarkably frost resistant. The quality of the fruits of such hybrids, however, needs much improvement. Hybrids between *C. Besseyi* and *C. tomentosa* are not only frost resistant but also rarely infected by *Rhodoseptoria ussuriensis* or even *Taphrina pruni*.

1362. 634.25:575.42
634.25 Sullivan

A new cling peach.

Canner 1936 : **83** : No. 21 : 10–11.

The new Sullivan peach is recommended to canners and growers as ready for commercial plantings. It ripens earlier or at the same time as the Phillips. The trees are more vigorous and fruit more heavily than the latter. The flesh is bright yellow in colour, firm and of good texture. As a variety with leaf glands, the Sullivan is expected to be immune to most diseases which attack the glandless leaf types and, according to orchard observations, it has resisted rust, scale and other adverse factors.

CITRUS FRUITS 634.3

1363. Brichet, J. 634.3

Les variétés commerciales d'Agrumes. Classification, sélection, etalonnage.

(The commercial varieties of Citrus. Classification, selection, standardization).

Bull. Synd. Algérien des Agrumes 1937 : No. 2 : 2nd ed. Pp. 52.

Intended as a guide to prospective growers, the main varieties of citrus—oranges, lemons, grapefruit and tangerines—are shortly described with indications as to the most suitable forms for growing in Algeria.

1364. 634.323:575(52)
SAKURAI, Y. 634.323 Mammoth
[A new Citrus hybrid "Mammoth Grapefruit" (Preliminary report).]
J. Soc. Trop. Agric. Formosa 1936 : **8** : 390–92.
Many new forms have been produced at the Shrin Horticultural Experiment Station by hybridization in *Citrus* but only a few have had any economic significance. Among these is the Mammoth grapefruit, a hybrid between white-fleshed Banhakuyu and Duncan, the latter being the male parent.
The characters of the new form and of its parents are given in tabular form. In most respects it is intermediate. The fruits of Banhakuyu weigh 1,920 grms. of Mammoth 1,070 grms. and of Duncan 313 grms. The number of perfect seeds per fruit in the three forms is 114, 70 and 7 respectively.

1365. 634.334:575.127.2:634.337
A new lemon developed in Florida.
Fruit World and Market Gr. 1936 : **37** : No. 10 : p. 9.
A Florida grower has succeeded in crossing the Mexican lime with a lemon and producing a new citrus fruit resembling the lemon but resistant to several diseases attacking the latter fruit.

1366. SHAMEL, A. D., POMEROY, C. S.
and CARYL, R. E. 634.334:575.252:575.42
Bud selection in Eureka and Lisbon lemons and progeny tests of bud variations.
Tech. Bull. U.S. Dep. Agric. 1936 : No. 531 : Pp. 44.
A number of bud variations found among trees of the Eureka and Lisbon varieties of lemon are described. Propagation tests have shewn them to be transmitted.
It was observed that buds taken from a normal branch of a tree shewing variation in another branch might also shew similar variation. The importance of constant selection of desirable types is emphasized.

VARIOUS SMALL FRUITS 634.4

1367. JULIANO, J. B. 634.441:581.481
Embryos of Carabao mango (*Mangifera indica* Linn.).
Philipp. Agric. 1937 : **25** : 749–60.
The polyembryony of the Carabao mango was investigated. Embryos were produced sexually as well as asexually but no certain means of distinguishing the sexual from the asexual embryo were found.
The reversion to polyembryony in Indian mangoes is discussed.

NUTS 634.5

1368. BAKHAREV, A. N. 634.5:575(47)
(Breeding new varieties of nuts and chestnuts).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 9 : 27–29.
Work in progress on various nuts includes crosses between various *Corylus* species, including *C. Avellana, C. maximus, C. Bergens* and *C. pontica*. Walnut crosses are made to produce new forms with large fruits, thin shells and high yield, for which purpose *Juglans mandshurica* and *J. cinerea* are being crossed with *J. regia*; frost-resistant walnuts are expected to be available in 1944. Collections of *Castanea dentata*, the hardiest known chestnut, are being made in South Dakota and will be crossed with the local *C. vesca* and the Japanese *C. pumila*.

1369. GRAVES, A. H. 634.531–2–1.521.6:575.127
Breeding disease-resistant chestnut trees.
Phytopathology 1937 : **27** : 129–30. (Abst.)
Species and hybrids of *Castanea* have been crossed to produce a disease-resistant, tall-growing type to replace *Castanea dentata*, now nearly extinct. After 7 years nearly 200 hybrids are being grown. The best, in its fifth year of growth is 15 ft. high.

PALMACEOUS AND OTHER FRUITS 634.6

1370. SHAMEL, A. D. 634.653:575.252

Bud selection in avocado varieties.

Yearb. Calif. Avocado Ass. 1936 : 146–49.

A brief discussion of the principles of bud selection. The importance of bud selection in maintaining the quality of the fruit is emphasized.

SMALL BUSH FRUITS 634.7

1371. 634.7

SLATE, G. L. 634.8

Newer varieties of small fruits and grapes.

Proc. 17th Annu. Mtg. Ohio St. Hort. Soc. 1937 : 89–99.

Among the new varieties briefly described are: raspberries, June, Newburgh, Taylor, Marcy, Indian Summer—all red forms; the purple Potomac and Sodus; and the black forms, Evans, Bristol, Dundee and Naples; the red currant, Red Lake; gooseberries, Poorman and Chautauque; strawberries, Dorsett, Fairfax, Catskill, Clermont and Culver; grapes, Fredonia, Portland, Ontario, Seneca, Brocton, Sheridan, Golden Muscat, Urbana, Van Buren and Caco.

1372. DARROW, G. M. 634.7:575(73)

Promising new berries and their breeding.

Trans. Peninsula Hort. Soc. 1935 : **25** : 13–15.

Brief accounts are given of some newer American varieties of strawberries, dewberries and raspberries and of their cultural requirements, together with a brief general description of the breeding work which led to their production and which is still proceeding.

1373. 634.711:575.12(47)

[**A new variety of raspberry**].

Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : **5** : p. 28.

A new variety of raspberry obtained at the Moscow Station for Small Fruits, by crossing Marlborough and Pyne's Royal, is characterized by large fruits and high yield.

1374. 634.717:575.127.2

DARROW, G. M. 634.717 Boysen

The Boysen dewberry (Boysenberry).

Issued by United States Department of Agriculture, Bureau of Plant Industry, Washington, D.C. September 1936, p. 1.

A brief description is given of this new *Rubus* form which came originally from California. Its origin is unknown but its similarity to the Young dewberry (Youngberry) suggests a similar origin, that is, a cross between an eastern dewberry and the Logan or Phenomenal blackberries or a native western trailing blackberry.

1375. SCHINDLER, O. 634.75:575(43)

Meine Erdbeerzüchtungen. (**My strawberry varieties**).

Geisenheim. Mitt. Obst-u. Gartenb. 1936 : **51** : 129–30 ; 148–51.

Brief descriptions of the qualities of strawberry varieties bred by the author are given. The famous variety Oberschlesien, which soon became a standard variety, cultivated in Holland, England, Switzerland and Austria as well as Germany, was bred from the cross Jukunda x Sharpless made in 1914. Other varieties arising from crosses made in that year were Proskau, Ernst Preuss and Johannes Müller, the first two from the cross Wunder von Köthen x Deutsch Evern and the third from Wunder von Köthen x Meteor.

Varieties bred more recently are Mathilde (1921), a grand-daughter of Oberschlesien, Pillnitz (1925) from Mathilde x Oberschlesien, Frau M. Schindler (1925) from Lucida perfecta x Johannes Muller and Herbstfreude (1921), another grand-daughter of Oberschlesien. The author is particularly proud of the variety Frau M. Schindler, named after his wife; it combines the fine strawberry flavour of old varieties like White Pineapple with the vigour, yield and large fruits of modern varieties. Herbstfreude bears two crops per year.

In conclusion, the author indicates lines along which much improvement is yet possible. Discussing the need for careful selection and the discarding of thousands of seedlings, he mentions that all seedlings from crosses with the variety Madame Moutót had to be rejected.

FORESTRY 634.9

1376. LARSEN, C. S. 634.97:576.16:575

The employment of species, types and individuals in forestry.

K. VetHøjsk. Aarsskr. 1937 : 69–222.

The question of species and the selection of suitable types is first considered. In most countries the types of trees grown are undergoing changes and modifications as a result of the introduction of foreign species and a study of the species in its original habitat is a necessary preliminary to the selection of forms for propagation. The importance of climatic races must be kept in mind and also the selection of biological types with special characters of value for forestry. When planting, it is suggested that the selected types should be grown at wide intervals so that can each tree can develop freely and shew its natural growth, otherwise, it is likely that those trees will be selected that succeed best in competition and other valuable characters are neglected.

Where trees are introduced as single specimens there is little chance of cross-pollination and the progeny remains uniform. With introductions on a large scale on the other hand there is always the danger of deterioration because of cross-pollination with trees of inferior type.

An account is given of the history of the introduction of the larch in Denmark and other countries, of the Douglas fir in Scotland and of *Abies Lowiana* in Denmark. The next section deals with the problems of flowering and pollination. Although normally cross-pollinated, self-pollination is probably more common in forest trees than is usually realized.

The ash is remarkable for the extreme variation in the proportion of male and female flowers and other instances in *Acer, Alnus, Pinus* and *Pseudotsuga* are quoted.

The distribution of the male and female flowers in monoecious forest trees must also be considered in this connexion. In some dioecious trees, *Juniperus communis* for example, there is a definite difference in the form of growth of male and female trees.

It is suggested that the time of development of male and female flowers is of fundamental importance for the production of good seed and examples of dichogamy are given.

The results of some experiments are given which shew that, at least in some cases, the plants resulting from self-pollination are not inferior to the progeny of cross-pollination.

Examples are given of species shewing obligate parthenocarpy. The question of hybrids is then dealt with. The occurrence of forms intermediate between two species is discussed. Cytological investigations have shewn in many cases that these intermediate forms are hybrids and probably unstable unless propagated vegetatively. It is suggested that specific names should not be given to these hybrids.

The probable hybrid origin of a number of species of forest trees is discussed. The results of artificial crosses are described including a large number of crosses between species of larch made by the author.

The concluding section discusses the breeding, in its widest sense, of special types of forest trees. To breed the best trees controlled pollination is essential and the question of self-sterility is important here and more information on the subject is needed.

The importance of vegetative propagation in the breeding scheme is emphasized and the future directions of breeding work are indicated (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 1106).

1377. 634.972–2.112:575.41

Selection at work.

J. Hered. 1937 : **28** : p. 34.

A brief summary of an experiment on the survival of twelve species of drought-resistant North American broad leaf trees planted in the northern Great Plains region between 1914 and 1917.

In 1934 three species had entirely disappeared and three had a survival of 90 per cent or more. The species best adapted to the conditions of the district was the Chinese elm.

1378. 634.972.1:576.312.35:576.354.4
NATIVIDADE, J. V. 634.972.1:576.312.34:576.356.5
Investigações citológicas nalgumas espécies e híbridos do género *Quercus*. (**Cytological studies in some species and hybrids of the genus *Quercus*).**
Separata das Publicações da Direcção Geral dos Serviços Florestais e Aqüicolas **1937** : **4** : Pp. 74.

The somatic chromosome number was found to be 24 in each of the following species: *Q. Suber* L., *Q. lusitanica* Lam., *Q. Ilex* L., *Q. fruticosa* Brot., *Q. coccifera* L., *Q. Robur* L., *Q. toza* Bosc., *Q. sessiliflora* Salisb., *Q. montana* Willd. and in the hybrids *Q. Ilex* x *Suber* P. Cout., *Q. coccifera* x *Ilex* and *Q. cerris* x *Suber*. The chromosomes were made up of 12 types and the same 12 types could be recognized in each species. The 12 types could be further divided into two groups of six, corresponding members of which differed only in size. Meiosis in the pollen mother cells was regular, 12 bivalents being formed with one to three chiasmata according to their size. Secondary association was observed at the first and second metaphases; on account of this and the morphology of the somatic chromosomes it is suggested that the basic number in *Quercus* may be six.
The similarity of the complements of the different species indicates a common phylogenetic origin and the chief factors in the differentiation of species appear to have been gene mutation and hybridization.

1379. FLOUS, F. 634.975:575.12
Transmission des caractères chez les hybrides de sapins. (**The transmission of characters in the hybrids of firs**).
C.R. Acad. Sci. Paris **1937** : **204** : 802–04.

From a study of the characters of *Abies Vilmorin*, a known hybrid of *A. cephalonica* x *A. Pinsapo*, the author draws the conclusion that the qualitative characters of the parents are transmitted unchanged to the hybrid while the quantitative characters appear in an intermediate condition.
From this standpoint *A. Pardei* is held to be a hybrid of *A. pectinata* x *A. Pinsapo* and *A. Bousii-Regis* a hybrid of *A. pectinata* x *A. cephalonica*.

VEGETABLES 635

1380. MAGRUDER, R. 635.00.14
New varieties and strains of vegetables.
Maryland Vegetable Growers Association, Baltimore, Md. 16th January 1936 : Pp. 11.

The qualities of a number of new strains and varieties of beans, beets, cabbage, cucumbers, melons, spinach and tomatoes are briefly indicated to enable growers to select those of possible value to be tried out in the different localities.

1381. STEINBERG, J. 635.00.14
Zur Sortenfrage im Gemüsebau. (**The variety question in vegetable cultivation**).
Geisenheim. Mitt. Obst- u. Gartenb. **1936** : **51** : 153–54.

The confusion caused by the ever-increasing number of varieties and the fact that many different forms are found under the same name necessitates the limitation and a better standardization of the varieties. With these reforms in view the advantages and use of a variety register for vegetables is briefly discussed.

1382. KRIVENKO, A. A. 635.25:575.127.2
(**Distant crossing with onions**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) **1936** : No. **11** : **14–15**.

In order to introduce winter-hardiness into the onion (*Allium cepa*) it was crossed with a hardy species *A. fistol*. The F_1 was intermediate in most characters, very luxuriant in growth,

perennial and without bulbs. The plants were quite hardy and flowered in the second year, being partially sterile. The hybrids are of considerable interest themselves for use as a vegetable and may produce the desired segregates in their progeny.
Hybrids were also produced between *A. cepa* and *A. altaic*, another hardy species. These hybrids formed bulbs.

1383. MAGRUDER, R. 635.34:575.11.061.6
A new color type in cabbage.
Science 1937 : **85** : 427–28.
In the third inbred generation from seed of a variety of cabbage from Tashkent, Turkestan, one family comprised 84 plants with coloured buds and 32 with white buds. The new character "coloured buds" takes the form of a pink or magenta coloration of the innermost leaves of the terminal bud, as distinct from the ordinary white or pale cream. A light reddish purple occurs on the external leaves of some plants.

1384. 635.35:575.11
MORETTINI, A. 635.35:575.127:581.162.3
Note di genetica del cavolfiore e miglioramento della coltura. (**Notes on the genetics of the cauliflower and on improvement in its cultivation**).
Nuovi Ann. Agric. Roma 1937 : **17** : 45–84.
As a preliminary to the production of improved strains of cauliflower, the genetics of the cauliflower and of related species of *Brassica* were studied.
Crosses were made between the cauliflower, *Brassica oleracea botrytis* L., and the following sub-species of *B. oleracea*, *B.o. sabauda* L., *B.o. capitata* L., *B.o. gongylodes* L., *B.o. gemmifera* D.C., *B.o. viridis* L. and *B.o. botrytis* L. and between the cauliflower and *B. rapa* L., *B. chinesis* L., *Raphanus sativus* L., *Sinapis alba* L. and *Crambe maritima* L. The crosses of the first group all succeeded, those of the second were unsuccessful though the crosses with *B. rapa* and *Raphanus sativus* formed fruits but without seeds. In the F_1 and F_2 hybrids of the first group the characters of the cauliflower appeared to be, for the most part, recessive.
In crosses made between varieties of cauliflower differing in time of maturity the F_1 hybrids were intermediate in this respect. Experiments on the existence of self-sterility of *B. oleracea botrytis* shewed that though the amount of seed set is low, the cauliflower is self-fertile. More seed is set when the plant is pollinated by another of the same variety and still more if a plant of another sub-species is used.
The self-pollination of the cauliflower for three generations led to the formation of strains of sufficient homogenicity for practical purposes.
The second part of the paper deals with practical methods for the improvement of the local races. A number of varieties from other countries were grown but none were entirely satisfactory.
The selection of the best local types is recommended and the maintenance of supplies of seed from pure stocks.

1385. 635.61:575(47)
635.63:575(47)
BEL-KUZNETSOVA, V. F. 635.646:575(47)
(**Breeding work with market garden crops**).
Bjulleten' Vsesojuznoi Akademii C.-X. Nauk im. V.I. Lenina (Bulletin of the Lenin Academy of Agricultural Sciences) 1936 : No. 11 : 11–12.
Two new melons, obtained by inbreeding, are described briefly; the first is superior in yield and sugar content, the second in size of fruit (5 kg.), yield and keeping capacity.
A new large-fruited cucumber with white spines and of improved keeping capacity has been produced also by inbreeding, and by the same method an improved egg-plant, producing 4–8 fruits per plant, each weighing about 270 grm., has been produced.

1386. 635.615–2.484–1.521.6:575
YOUNKIN, S. G. 635.615 Improved Kleckley Sweet No. 6
New watermelon from Iowa Kleckley 6 resists wilt.
Market Gr. J. 1937 : **59** : 160–61.
Improved Kleckley Sweet No. 6 is a new selection of Kleckley Sweet, of a quality equal or superior to any available Kleckley Sweet strain. It has been rated as 85 per cent resistant to wilt.

1387. SEATON, H. L., HUTSON, R. and MUNCIE, J. H. 635.63:575(77.4)
635.63 National Pickle
The production of cucumbers for pickling purposes.
Spec. Bull. Mich. Agric. Exp. Sta. 1936 : No. 273 : Pp. 40.
In the section on varieties an account is given of the origin of the variety National Pickle. It originated at Michigan Agricultural Experiment Station as a selection made in 1925, from Snow's Perfected Pickle and was inbred, growing two generations a year. In 1928 seed was distributed for testing and in 1929 the variety was named. Breeding has been continued at Michigan State College to improve the strain further.

1388. LESLEY, J. W. 635.64:575.116.1:576.356.4
Crossing over in tomatoes trisomic for the "A" or first chromosome.
Genetics 1937 : **22** : 297–306.
From the progeny obtained by crossing triplo-A tomatoes of the constitution $d_1PS/D_1pS/D_1Ps$ with a d_1ps/d_1ps diploid it was estimated that the crossing-over between the d_1 and s loci in the ovules was 30 per cent, substantially the same per chromosome as in the diploid.
With respect to dominance relations it was found that D_1 was completely dominant over d_1d_1, but P and S were incompletely dominant over pp and ss respectively.
Random chromatid assortment occurs at the d_1 and p loci, shewing that chiasmata are formed between them and the centromere. This, in view of the association of the A chromosomes at meiotic prophase, suggests that the loci lie between the non-satellited end and the centromere.

1389. SCHLÖSSER, L.-A. 635.64:575.243:576.341
Ein neuer Weg zur Auslösung von Mutationen. **(A new way of inducing mutations).**
Z. indukt. Abstamm. -u. VerebLehre. 1937 : **72** : 540–54.
The method consists of growing the plants under crowded conditions in light sandy soil and with as little water as possible. This causes an increase in osmotic pressure and it is to this that the resulting mutations are attributed. By this method five different mutations, segregating in monohybrid ratio in F_2 were produced in a homozygous strain of *Lycopersicum cerasiforme*, two occurring twice and one occurring three times, making nine in all. Two of the mutants were similar to simple recessive forms occurring in *L. racemigerum* and another was already known in *L. cerasiforme*.
One of the mutants caused marked elongation of the tips of the leaflets and therefore of the midrib also. When a tetraploid was produced from the homozygous recessive, the working of the gene was observed to be considerably changed and in certain leaflets the remarkable effect was produced of the midrib leaving the leaf-blade and growing free in the air.
The author distinguishes two classes of induced mutations, "natural" and "artificial", according to whether they are produced by agencies likely to affect the organism under natural conditions or not and stresses the importance of the former in relation to the origin of species.

1390. PORTE, W. S. 635.64–2–1.521.6:575(73)
Development of disease resistant varieties of tomatoes.
Rep. Md. Agric. Soc. (1935) : 1936 : **20** : 264–69.

The method of breeding for disease resistance is briefly outlined and an account is given of the tomato varieties resistant to *Fusarium* wilt and nail-head rust developed in the U.S.A. as a result of work started in different state experiment stations in 1910 and by the United States Department of Agriculture in 1915.

Work is now in progress on the inheritance of resistance to *Fusarium* wilt. No variety has yet been found which is resistant to the mosaic viruses. On the Pacific coast, work is in progress on resistance to *Verticillium* wilt and curly top, a virus disease. Lines resistant to *Verticillium* wilt have been developed but no standard varieties which are resistant to curly top under severe infestations of the disease-carrying leaf hoppers have been found. Dwarf varieties have been shewn to be slightly resistant to curly top. Resistance to spotted wilt, another virus disease, is also being sought in California. Considerable progress has been made in Ohio and Massachusetts in breeding for resistance to tomato leaf mould. The resistance of the red currant tomato is being transferred to commercial types by repeated back-crossing.

1391. TATEBE, T. 635.646:575.127.2:576.354.4
[Genetic and cytological studies on the F_1 hybrid of scarlet or tomato eggplant (*Solanum integrifolium* Poir.) x (*Solanum Melongena* L.)].
Bot. Mag. Tokyo 1936 : **50** : 457–62.

Using the eggplant variety China-daien, the cross was only successful with the scarlet eggplant as female. The F_1 hybrid shewed heterosis and resembled the scarlet eggplant more than *Solanum melongena* except that the purple plant colour of the eggplant is dominant over the green of the scarlet eggplant. The hybrid produced adventitious roots on the lower parts of the shoots, a character observed in the tomato but in neither of the parental forms. The F_1 was completely sterile, but towards the end of the season produced small parthenocarpic fruits.

The haploid chromosome number in both parents and in the hybrid was 12. Meiosis was regular in the hybrid, but after the tetrad stage the pollen grains degenerated and only abortive pollen was found in the anthers.

1392. 635.651:575–183
SOSA-BOURDOUIL, C. 635.656:575–183
Remarques sur l'hérédité du poids des graines chez la fève et le pois. (**Remarks on the inheritance of seed weight in beans and peas**).
Rev. Bot. Appl. 1936 : **16** : 463–66.

A cross between the broad bean and the horse bean with an average seed weight of 1·40 grm. and 0·49 grm. respectively gave F_1 seeds of the shape and size of the maternal parent. In the F_2 and F_3 the weight of the seeds was, in the majority of cases, about intermediate, the average weight of the seeds being 0·80 grm. while 0·97 is the average weight of the seeds of the parents.

The heavy large-seeded broad bean type was recessive. The same conclusion was reached with *Pisum*.

P. Jomardii Schrank. with smooth seeds was crossed with *P. sativum* L. var. Le Délicieux with wrinkled seeds. The average weights of the seeds was 0·12 and 0·36 grm. respectively. The weight of the seeds of the F_1 resembled that of the maternal plant. In F_2 and F_3 the weight was intermediate but with a marked tendency towards the lower weight (*P. Jomardii*). Similar results were obtained with crosses between *P. arvense* and *P. sativum*.

1393. WALKER, J. C. 635.652–2–1.521.6:575
Disease-free and disease-resistant beans.
Canner 1936 : **82** : No. 11 : Part 2 : 59–60.
This address to the National Canners' Association and allied bodies briefly reviewed the development of disease resistant beans, with reference to anthracnose and mosaic in particular. The breeding of the Wisconsin Refugee and the Idaho Refugee strains and their performance in recent trials is described (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 816).

1394. DUNDAS, B. 635.652–2.42–1.521.6:575.11
Inheritance of resistance to powdery mildew in beans.
Hilgardia 1936 : **10** : 243–53.
Varieties of French beans, *Phascolus vulgaris* L., were tested for resistance to powdery mildew, *Erysiphe polygoni* D.C. and Hungarian, Lady Washington, Pinto, Yellow and Pink were resistant, Frijole negros, Long Roman and *P. vulgaris* 5003, intermediate and Robust and Red Kidney susceptible. Crosses were made between Pinto and Robust and Pinto and Long Roman and the results in the F_1, F_2 and F_3 shewed that resistance is due to a single dominant factor. Resistance was slightly greater in the later stages of growth than in the seedling stage.

1395. LAMPRECHT, H. 635.656:575.11.061.63
Genstudien an *Pisum sativum.* II. Gestreifte Samenschale und ihre Vererbung. (**Gene studies on *P. sativum* II. Striped seed coat and its inheritance**).
Hereditas, Lund. 1937 : **23** : 91–98.
The character studied is the presence of violet stripes on the mature seed coat, similar to those produced in *Phascolus vulgaris* by the gene *S*. It was found to be produced by a single dominant gene, given the symbol *Ast*, the recessive being *ast* (*astriata*—not striped). The genes $V-v$, $N-n$, $M-m$ and $Pl-pl$ were also segregating in the cross studied and it was found that *Ast* was independent of all these with the possible exception of *Pl*. Here there was evidence of linkage, with a crossing-over value of 39·3 per cent, but the author does not consider it conclusive, since out of 500 F_2 seeds, only 421 plants were obtained which could be scored for all possible characters.

1396. LAMM, R. 635.656:575.113.3:575.113.42–181.13
Length factors in dwarf peas.
Hereditas, Lund. 1937 : **23** : 38–48.
Evidence is presented to shew that both polymeric factors and multiple allelomorphs are concerned in the production of dwarf, crypto-dwarf and slender pea plants. The factor cy_1 is common to both the crypto-dwarf and the slender modification of dwarf, while at a second locus cy_2^c with cy_1 gives crypto-dwarf and cy_2^s with cy_1 gives slender; cy_2^c and cy_2^s are multiple allelomorphs of Cy_2. In the author's crosses involving eleven lines, of which seven were dwarf, two crypto-dwarf and two slender, three types of dwarf were found, $Cy_1\ Cy_1\ cy_2^c\ cy_2^c$, $Cy_1\ Cy_1\ cy_2^s\ cy_2^s$ and $cy_1\ cy_1\ Cy_2\ Cy_2$. The author gives a fourth possible type $Cy_1\ Cy_1\ Cy_2\ Cy_2$, but this was not found.
Neither of the *cy* loci were found to be linked with those of *r*, *tl*, *i* or *a*.
The author's factor cy_2^c corresponds with Rasmusson's cry_2 and his cy_2^s with de Haan's *lb*.

1397. SOSA-BOURDOUIL, C. 635.656:581.192:575.12
Comparaisons entre quelques pois et leurs hybrides, relativement à la composition élémentaire des graines. (**Comparisons between some peas and their hybrids, relative to the fundamental composition of their seeds**).
C.R. Acad. Sci. Paris 1936 : **202** : p. 1091.
The carbon, hydrogen and nitrogen contents of the seed of smooth and wrinkled varieties of *Pisum sativum* and the seeds of *P. arvense* and *P. Jomardii* and of some of their hybrids were

investigated. The amount of carbon and hydrogen shewed very little variation in either the parents or the hybrids. There was more variation in the amount of nitrogen and this appeared to be a varietal character. There was no connexion between the amount of nitrogen and the colour or texture of the seeds in the hybrids.

1398. 635.656:581.48:519.24
GRODECKÝ, V. 633.35:581.48:519.24
Studie dědičnosti některých hodnot variační statistiky, zvláště korelace mezi šířkou a váhou semêne u čiˆtých linií *Pisum sativum, Pisum arvense* a *Vicia cuspidata.* (**Studies on the inheritance of some values of variation-statistics, with special reference to the correlation between the breadth and weight of seeds in pure lines of *P. sativum, P. arvense* and *V. cuspidata*).**
Rec. Inst. Rech. Agron. Rép. tchéchosl. 1936 : **151** : Pp. 90.

In different years and in different pure lines of *Pisum sativum, P. arvense* and *Vicia cuspidata* the following values for breadth and weight of seeds were studied: mean, standard deviation, variation coefficient, correlation between the two and the two regression coefficients.

The means in pure lines of *P. sativum* varied from year to year in a complex manner, characteristic for each pure line; in *P. arvense* and *V. cuspidata* the means were nearly constant. The standard deviation in all pure lines of the three species varied from year to year, with a tendency to increase as the means diminished. The coefficients of variation varied from year to year in all pure lines, to a degree differing in the different lines.

In all pure lines there was a significant positive correlation between width and weight, which was higher in *P. sativum* than in the other two species. In *P. sativum* it varied very little from year to year but in *P. arvense* and *V. cuspidata* it varied considerably to an extent characteristic of the line and group concerned.

The regression coefficient of weight upon breadth in pure lines of *P. sativum* and of breadth upon weight in pure lines of both groups were almost constant. The regression of weight upon breadth in *P. arvense* and *V. cuspidata* varied from year to year.

BOOK REVIEWS

SHAW, F. J. F. 519.24

A handbook of statistics for use in plant breeding and agricultural problems.

Imp. Coun. Agric. Res., Delhi 1936 : Pp. 182. Price Rs. 4–6 (7s. 3d.).

Of the books which have appeared on the specific application of statistical methods to agricultural experimentation this one is to be commended for its lucid style, and for the wealth of numerical illustration which it provides. The first part of the book contains a discussion of frequency distributions, calculation of averages and methods of dispersion, tests of significance and the problem of correlation and regression. The author then turns to the question of field trials, and after sketching various methods of layout, comes down in favour of the randomized blocks and Latin square systems. The statistical reduction is described in detail, both for simple and complex, including long term, trials, and one of the most valuable features of the book is the working out to the last detail of the arithmetic of a number of actual experiments. There is a chapter on analysis of covariance which stops short of recent advances in this field. Useful tables and a list of formulae are provided in an appendix.

The book has been carefully compiled, and only a few slips have been noted. Thus, on p. 16 the Sheppard correction should be 1/12 of the *square* of the class interval; on p. 32 E_p should be 0·0088, and on p. 164 a minus sign has been left out of equation (46), while the statement in the last sentence of this paragraph is wrong. J. W.

†SCHMUCKER, T. 57:9

Geschichte der Biologie—Forschung und Lehre. (**History of biology—research and theory**).

Vandenhoeck & Ruprecht, Göttingen 1936: Unbound RM. 10; Bound RM. 12. Pp. 296.

In writing this history of biology the author has been concerned not only to trace the discovery of facts and the development of ideas and modes of thought, but also to point the moral, as it were, or in his own words "to serve the future, especially of Germany".

The material is divided roughly into sections, the first dealing with the ancients (the oldest civilizations and the Greeks and the Romans), the Arabs and the Middle Ages. A chapter on the transition from Scholasticism and Humanism to empirical science leads to modern history, which is covered under the following headings: the beginning of natural history in the sixteenth century; the seventeenth century; the eighteenth century—Kant; the nineteenth century up to Darwin; Darwin, and the advance of evolution; and finally the period since Darwin. It will be noticed that great importance is attached to Darwin and the introduction of the evolutionary outlook. Although the general arrangement of the book is chronological, this order is cut across within the later chapters by the division of the science into its branches. A point emerging from the last section which may be mentioned here is the general importance the author attributes to the development of the genetical viewpoint. In his introductory chapter the author states that we shall see how great has been the contribution of German workers. It is indeed true that the importance of German work in the development of biology can hardly be over-estimated, yet in the chapter on genetics for instance, that branch of biology with the history of which the reviewer is most familiar, it is possible to detect a tendency to give credit to German workers for discoveries which were actually made outside that country. These errors in assigning priority are intrinsically of little importance in a book of such wide scope as the one before us, but they may engender an unfortunate suspicion of bias. An error which is rather important from the personal point of view is to be found in this same chapter, when the author (p. 248) couples Pearson and Bateson as biometricians and followers of Galton; Pearson's initial is given as "W.", though the reference is presumably to K. Pearson.

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† 25 per cent reduction outside Germany.

The errors mentioned do not greatly detract from the value of the book, which is stimulating and interesting to read. The flavour of National Socialism which is noticed here and there will doubtless provoke some keen discussions outside Germany.
As the book is not intended as a scientific reference work, only a short bibliography of some general works is given. There is a subject index and an author index; the fact that the latter contains some 900 names gives an indication of the ground covered.

WEXELSEN, H. 575:633
Arv og foredling hos våre dyrkede planter. (**Genetics and breeding of cultivated plants**).
J. W. Cappelens, Oslo 1935 : Kr. 3.50. Pp. 112. 30 figs.

An elementary text book written for the use of schools, for agriculturists, gardeners and for anyone interested in the breeding of plants. It provides briefly and in non-technical language the necessary principles of plant breeding, the methods employed and some of the results obtained.
It is well illustrated by diagrams and photographs, some of the latter shewing the results of the author's own experiments.

WINGE, Ø. 575.1
Arvelighedslaere—paa eksperimentelt og cytologisk grundlag. (**Genetics—on an experimental and cytological basis**).
H. Hagerup, Copenhagen 1937 : 2nd Ed. Pp. 475. 168 figs.

The very considerable increase in knowledge during the eight years that have elapsed since the first edition appeared has led the author to publish a second edition of his excellent text book on the principles of genetics for Danish readers. Parts have been revised and parts added to, to the enlargement of the whole. The additions include the experimental production of mutations and the new work on chromosome structure.
The reader is thus kept informed of the progress of genetical research.
The whole work is admirably produced, well illustrated, clearly and simply written, and the author has made use of a number of his own experimental results as examples of the principles discussed. A good bibliography concludes the volume.

†TIMOFÉEFF-RESSOVSKY, N. W. 575.243
Experimentelle Mutationsforschung in der Vererbungslehre. Beeinflussung der Erbanlagen durch Strahlung und andere Faktoren. (**Experimental research on mutation in relation to genetics. Influencing the genes by radiation and other factors**).
Theodor Steinkopff, Dresden & Leipzig 1937 : Unbound RM. 15 ; Bound RM. 16.50. Pp. x + 184. 52 figs. 6 illus. 49 tables. (Wiss. Forsch. Ber. 1937 : **42**).

H. J. Muller's now classical work on X-ray induced mutations in *Drosophila* has produced in the last ten years a new branch of genetics, the experimental study of mutations. In the development of this most important branch, no small part has been played by the author of the book under review.
The first three chapters are introductory in nature, the first giving a brief outline of the chromosome theory of heredity, the second a survey of early attempts to induce inherited changes, including Lamarckian experiments, while the third describes those pre-Muller experiments with *Drosophila* in which the influence of temperature and ionising radiations on crossing-over, non-disjunction and separation of attached X-chromosomes was demonstrated.
The fourth chapter deals with the qualitative and quantitative aspects of spontaneous mutations and includes an account of the *ClB* and the attached-X techniques used for determining mutation rates in a given X-chromosome of *Drosophila*.

Only after he has thus cleared the ground does the author turn to Muller's successful experiment with X-rays in 1927 and its confirmation in a wide range of animal and plant material. In the next two chapters the effect of short-wave radiations is more closely analysed, attention being directed to such questions as the direct or indirect action of radiation, dosage, intensity, wave-length, the mutability of different genes and of related species and a comparison of induced and spontaneous mutations.

The author now turns to the effect of temperature and other factors in inducing mutations. He considers that more work is needed on the effect of chemicals because they offer a prospect of a specific effect.

The next chapter is perhaps the most interesting in the book; here is discussed the nature of the process of mutation and the structure of the gene. In connexion with gene structure brief but clear accounts of step-allelomorphism and the position effect are given. On the basis of the biophysical aspect of the phenomena a theoretical model is developed to illustrate the author's concept of the process of mutation and the consequences of this concept are briefly explored.

The last chapter deals with the applications of the expêrimental induction of mutations, the most important being the application to genetical research. The application to breeding is briefly considered. The book ends with a bibliography of some 28 pages and a subject index. The work is to be recommended as a concise, thorough and clear account and an authoritative one. To a large extent it is concerned with work on *Drosophila* and this will make it of use to those who find themselves unable to keep up with the voluminous literature on that fly.

COMBES, R. 576.314

La vie de la cellule végétale. L'enveloppe de la matière vivante. (**The life of the plant cell. The envelope of the living matter**).

Armand Colin, Paris 1937 : Collection No. 203 : 13 fr. Pp. 216 + 12. 26 figs.

In continuation of the author's earlier studies on the life of the plant cell—the living matter and the inclusions of the living matter—the structure of the cell wall is here considered.

After brief chapters on the morphology and physical structure of the wall, the author deals with the chemical composition and the physiology of the membrane, and finally in a second part with the tissues producing essences and resins, the chemical structure and physiology of these substances.

ST. JOHN-BROOKS, R. (Editor) 576.8:061.3

Report of proceedings. Second International Congress for Microbiology, London, 1936.

Harrison & Sons, Ltd., London 1937 : Pp. xiii + 579.

The importance of the science of microbiology is reflected in the record of the Second International Congress held in London 25th July—1st August 1936. The abstracts of the papers are grouped under the eight headings. (1) General biology of micro-organisms; (2) virus and virus diseases in animals and plants; (3) bacteria and fungi in relation to disease in man, animals and plants; (4) economic bacteriology; (5) medical, veterinary and agricultural zoology and parasitology; (6) serology and immunochemistry; (7) micro-biological chemistry; (8) specific immunization in the control of human and animal disease.

Of interest for plant breeders are the papers by Prof. Gratia and Dr Manil on the non-inheritance of the mosaic virus (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 922) and the discussion by Prof. Brown on the "Nature of resistance to fungus disease in plants" shewing that in many cases resistance is a property of the living tissue and does not depend on the presence or absence of toxic or inhibitory substances.

*Boysen Jensen, P. 577.17

Growth hormones in plants.

McGraw-Hill Publishing Co., Ltd., London 1936: 21s. 0d. Pp. xiv + 268. 64 figs. 17 tables.

The literature on plant hormones, those elusive bodies whose very existence was questioned up to a few years ago, has grown at such an alarming rate that few biologists who are not working on the subject have been able to keep pace with it. A comprehensive review of the present position was therefore very much needed, and Dr Boysen Jensen is peculiarly well fitted to supply this, having done a great deal of the important experimental work on the subject himself. The present volume is a translation of the author's earlier work in German, but has been revised and extended to cover the literature of 1935.

Growth promoting properties are now known to be possessed by a great variety of substances, of both vegetable and animal origin, but three substances have been found to be more potent than any others and are now chiefly understood by the term growth substance or plant hormone; they are known as auxin *a*, auxin *b* and 3-indole acetic acid (or heteroauxin). They have all been extracted in crystalline form and their chemical composition and structure is accurately known.

Small quantities of these substances have the effect of stimulating growth in certain organs, such as stems and leaves and the terminal bud of a shoot, and of retarding or inhibiting it in roots and lateral buds. Various theories have been put forward to explain this peculiar action but so far none is entirely satisfactory. The hormones have the further peculiar property of being capable of travelling along a gradient from a lower to a higher concentration. Their behaviour and effects are evidently connected with the vital, possibly the electrical, activity of the plant tissue.

The hormones have the power of regulating plant growth and of bringing about differential growth responses such as phototropism and geotropism. Of more interest to plant breeders is their stimulating action on cell division; applications of growth substance have been known to stimulate cambial activity, leading to growth in thickness and callus formation, and upon occasion to tumours and other products of hypertrophy. Furthermore, applications of growth substance to cuttings promotes the development of new roots, a certain proportionality having been observed between its concentration and the number of roots formed. The stimulation of root formation can be brought about not only by the growth hormones (and bodies containing them such as orchid pollinia, urine, etc.) but by a variety of other products including ethylene. These results may be of particular importance to breeders who desire to stimulate vegetative propagation in crops where this is normally difficult, and the application of orchid pollinia has already been used successfully in inducing regeneration and the production of polyploid shoots by decapitation in a species of *Nicotiana* which has not previously been susceptible to such treatment (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 972).

Geneticists will be interested to learn that the amount of growth substance produced by the dwarf maize mutant Nana is the same as in the normal, the inhibited development being due to a destruction of the hormone resulting from an abnormally high catalase and peroxidase activity.

Brontë Gatenby, J. 578.6

Biological laboratory technique. An introduction to research in embryology, cytology and histology.

J. & A. Churchill, London 1937: 7s. 6d. Pp. vii + 130 + 16. 8 illus.

This small book might be described as an introduction to the "Microtomist's Vade-mecum," edited by the same author.

The first chapter deals with laboratory equipment and then after a chapter on the treatment of living animal cells there are two chapters on smears, the first of which covers fixing and staining and the second microchemical tests. The next chapter deals with whole mounts

* It may be of interest to readers to know that these hormones are now on sale in a concentrated form suitable for use in horticultural practice, especially in connexion with the rooting of cuttings and the stimulation of vegetative propagation.

and then follows one on fixation methods, which includes recipes for a wide range of fixatives. The succeeding chapter, which deals with imbedding, describes the dioxan and N-butyl alcohol techniques as well as the more standard paraffin and celloidin methods; section cutting is also covered in this chapter. There follows a chapter on stains and staining and a final chapter on methods recommended for specific materials, with a brief note on centrifuges. The book ends with two addenda of miscellaneous information and a subject index.
The fact that the book has been written throughout with the beginner's needs in mind makes it particularly suitable for an amateur working without the guidance of an experienced teacher. It is concerned almost exclusively with animal material.

GOOD, R. 581.6
Plants and human economics.
University Press, Cambridge 1933 : 5s. 0d. Pp. ix + 202. 8 maps.
This brief account of economic botany is intended primarily for those in senior classes of schools and junior classes of universities, but has been written so as to be understood also by those who are not students of biology.
After an introductory chapter the author describes the nature of food and shews that all food is ultimately derived from plants. The next chapter describes in simple terms the metabolism of green plants, while the following two chapters are concerned with agriculture, one on the factors limiting production and one on science and agriculture; plant breeding is mentioned in the latter. There follow seven chapters in which the economic plants are listed with explanatory notes and their Latin names. This section is very comprehensive and the only plants of any importance which have been omitted appear to be the insecticides. The last chapter of the book deals with the economic botany of Great Britain.
The book is illustrated by maps and there is a useful appendix in which the economic Phanerogams are listed under their Latin names in systematic order, with their English names also given. There is also a short bibliography and a subject index.

†KOSCH, A. 581.9(43)
Was blüht denn da? (**What is that flower?**)
Franckh'sche Verlagshandlung, Stuttgart 1936 : RM. 2.50. Pp. 136.
43rd Ed. 485 figs. 8 pls.
A flora for beginners. The common plants of Germany are grouped according to the colour of the flowers and the brief descriptions are arranged in tabular form under the headings: time of flowering; inflorescence, flower characters; leaf shape; height, characters of the plant. A large number of the plants are illustrated by black and white drawings or by coloured plates. The main trees and bushes, grasses, cereals, rushes, sedges and ferns are dealt with similarly at the end of the book.

KOMAROV, V. L. (Editor) 581.9(47)
(**Flora of the U.S.S.R. Volume VI**).
Edited by the Scientific Academy of the U.S.S.R. Leningrad 1936 : 21 roubles : (Bound 2 roubles extra). Pp. xxxvi + 956.
The sixth volume of this flora, the first five volumes of which have already been reviewed (Cf. "Plant Breeding Abstracts", Vol. VII, p. 256), deals with the *Chenopodiaceae, Amaranthaceae, Nyctaginaceae, Thelygonaceae, Phytolaccaceae, Aizoaceae, Portulacaceae* and *Caryophyllaceae*. Two indexes are appended—one giving the Russian names of the families, genera and species included in the volume, and the other giving the Latin names of the order, families, species and synonyms of the plants cited.

585.421
ARMSTRONG, S. F. 633.2
British grasses and their employment in agriculture.
University Press, Cambridge 1937: 3rd Ed. 15s. 0d. Pp. ix + 350. 194 figs.
The third edition of the well known work maintains the purpose and scope of the original. Part I, the botanical section, has been revised and some additions made; Part II,

the agricultural section, has been rewritten and enlarged to include the results of recent work on grasses and grassland. Some notes have also been added on those leguminous plants which are used in seed mixtures, and there is a chapter devoted to the formation and maintenance of lawns and greens.

The importance of the book lies in the combination of the botanical descriptions, which enable the reader to identify correctly the British grasses, with the relation of the grasses to agriculture. The scientific treatment of grassland has become an important branch of farming, and towards the furtherance of modern methods the book makes a valuable contribution.

WRIGHTSON, J. and NEWSHAM, J. C. 63
Agriculture, theoretical and practical. A textbook of mixed farming for large and small farmers and for agricultural students.
The Technical Press, Ltd., London 1937 : 3rd Ed. Revised reissue. 12s. 6d. Pp. xx + 648. 334 figs.

To cover the whole field of practical agriculture in one handy volume is no mean achievement, and the reissue of the third and revised edition of this book will be welcomed by a wide circle of readers. Within the limits of space necessarily imposed, the authors deal with all practical aspects of agriculture and do not neglect the theoretical side.

The section on horticulture gives a short account of the botany of the plant and includes a brief section on heredity and variation.

The index is rather sketchy and some printer's errors have been overlooked, notably Fig. 177 which is upside down.

RUSSELL, E. J. 631.4
Soil conditions and plant growth.
Longmans, Green & Co. Ltd. London 1937 : 7th Ed. 21s. 0d. Pp. viii + 655. 65 figs. 108 tables.

This book, the first edition of which was published in 1912, has long been a standard work. In this, the seventh edition, new material has been incorporated and some old material dropped.

631.421
FISHER, R. A. 519.24
The design of experiments.
Oliver & Boyd, Edinburgh & London, 1937 : 2nd Ed. : 12s. 6d. Pp. xi + 260. 39 tables. 5 figs.

The early appearance of a second edition is a welcome testimony to the demand for a book, the like of which has never appeared before. The main object is to describe and illustrate the principles of experimental design. In the more elaborate sections dealing with complex factorial designs and the method of compounding, the author is dealing with agricultural experiments, which are a fruitful field for the development of such designs. That this is not the only application is, however, manifest from an added section in the fifth chapter which shews how an exceptional design in a cotton mill experiment enabled a defect in a spindle of a particular composition to be detected, though not previously known to exist. The only other addition is an interesting set of practical exercises for the reader, illustrating some of the newly developed combinational arrangements. J.W.

633:663
634:663
BOIS, D. 635:663
Encyclopédie Biologique. XVII. Les plantes alimentaires chez tous les peuples et à travers les ages. Histoire, utilisation, culture. Vol. IV. Les plantes à boissons. (**Biological Encyclopedia. XVII. Alimentary plants of all peoples and throughout the ages. History, use, cultivation. Vol. IV. Beverage producing plants**).
Paul Lechevalier, Paris 1937 : 120 fr. Pp. 600. 111 figs.

In the fourth volume of this encyclopedia (Cf. "Plant Breeding Abstracts", Vol. V, p. 375) the plants producing beverages of all kinds are described and illustrated, together with an account of their history and uses.

Sivers, S. J. von and Haffenrichter, H. 633.14
Unser täglich Brot—Lebensgeschichte des Roggens. **(Our daily bread—the life-history of rye).**
Essener Verlagsanstalt, Essen 1936 : Pp. 112. 60 illus. 8 pls.

The story of the development of a grain of rye from the time of sowing to harvest is here told with a wealth of detail, which while strictly scientific in fact, is so far removed in treatment from the usual technicalities as to transform it into a work of art. Even the numerous illustrations—some of them coloured plates of sections of the plant—though they adhere, in essentials strictly to fact, are remarkable artistic productions.

Wallace, H. A. and Bressman, E. N. 633.15
Corn and corn growing.
John Wiley & Sons, Inc., New York 1937 : 4th Ed. : 13s. 6d. Pp. vii + 436. 117 figs. 41 tables. (Chapman & Hall, London).

First published in 1923, this book has been completely revised for the fourth edition, the greatest emphasis having been placed on the revisions that deal with the economics and the genetics of maize. It includes chapters on classification, varieties, breeding and on judging and testing for yielding abilities and covers all aspects of the growing of maize as well as the more general and commercial topics.

The chapter on corn breeding contains a description of the technique of inbreeding used in the development of inbred strains for crossing and also a brief account of the genetics of maize including lists of the factors in the ten linkage groups.

†Nebel, B. R. 634:576.3
Zellforschung und Neuzüchtung beim Obst und bei der Rebe. **(Cytology and breeding new forms in fruits and vines).**
Eugen Ulmer, Stuttgart-S. 1937 : RM. 1.65. Pp. 58. 10 figs. (Heft 29 der Schriftenreihe "Grundlagen und Fortschritte im Garten- und Weinbau").

The elementary cytology of the dividing cell is first briefly described in simple language in order to give the practical gardener a basis for the results of recent researches on the breeding of fruit trees.

The second part is devoted to the application of the principles already explained, to the fruits themselves.

This booklet, it is claimed, is the first which has given the practical man the cytological facts in German, and as such it offers a clearer understanding of the recent developments in fruit-breeding and of the future possibilities for progress.

634–2.7
Massee, A. M. 633.79–2.7
The pests of fruits and hops.
Crosby Lockwood & Son, London 1937 : 15s. 0d. Pp. 294. 26 pls.

In producing a book on the pests of fruit trees, the author supplies a long-felt want, as the last book on the subject was published in 1909. Since that time our knowledge both of the pests and of the measures for their control has increased enormously and the commercial fruit grower and gardener should find this manual almost indispensable.

The main insect and allied pests of fruit and hops are described so as to enable the grower to recognise them either by their appearance or from the nature of the damage they cause, and technical descriptions have been omitted. Notes on the life cycle are given followed by an account of control measures.

There are chapters on beneficial and harmless insects, insecticides and on spraying equipment and methods. The hope is expressed in the preface that in the future resistant varieties will to a large extent replace the control measures now necessary.

HADER, B. and HADER, E. 634.771

Green and gold. The story of the banana.

The MacMillan Company, New York 1936 : $1.00. Pp. 48. illus.

The history of the banana, its cultivation and distribution is here made into a story for children. Instructive without the least heaviness and unusual without being fantastic the book with its abundant and attractive coloured illustrations makes an immediate appeal which no child could resist.

OPPERMANN, A. and GRUNDTVIG, V. 634.9:016(48.9)

Bibliographia universalis silviculturae. I. Dania. Den danske skovbrugslitteratur indtil 1925. (**The universal bibliography of silviculture. I. Denmark. The Danish literature on silviculture up to 1925**).

Levin & Munksgaard, København. Half-vol. 1, 1931 : Pp. i–xxxii + 290 ; Half-vol. 2, 1935 : Pp. xxi–lix + 291–468.

The first suggestion for a universal bibliography of forest literature was put forward as early as 1903, but a series of misadventures delayed the completion of the scheme and after the world war it was decided that each country should first issue a bibliography of its own forest literature before a certain date.

In this project, Denmark has led the way with a very comprehensive bibliography. The first half-volume contains a list of the papers up to and including 1925, arranged alphabetically under the author's name followed by a list of anonymous publications or works by more than three authors, arranged alphabetically according to title. A final list of collective works is given. The second half-volume provides a list of the abbreviations made use of for the journals quoted and is followed by a classified subject index, arranged on an original decimal system and by which there is a reference by number to the lists in the first half-volume.

HOARE, A. H. 635–1.5

Vegetable crops for market.

Crosby Lockwood & Son, London 1937 : 7s. 6d. Pp. 198. 36 illus.

A variety of factors has combined to increase enormously of recent years the production of vegetables for market. The competition thus engendered makes it essential for the grower to make use of the most recent scientific knowledge.

In a practical form this work provides the grower of vegetables with the necessary basis for successful cultivation. Each crop is treated in turn, the best varieties are named, information is provided on the most suitable soils, preparation of the soil, manuring, seed sowing, cultivation, marketing and growing for seed. A chapter is devoted to early and forced crops and one to culinary herbs.

The appendices deal with (1) brief descriptions of the principal diseases and pests, (2) the principal containers for market produce, and (3) an account of the fertilizers for the vegetable grower. A notable feature in the chapter on seeds and plant breeding is the insistence on the importance of the use of only the best seed from proved stocks.

BAILEY, L. H. 635.62

The garden of gourds.

MacMillan & Co., Ltd., New York 1936 : 12s. 6d. Pp. 134. 42 pls.

The writer is an enthusiastic grower of gourds and gives practical hints for their cultivation and for the preparation of their fruits for ornamental purposes.

Many gourds, all of the *Cucurbitaceae*, are described and illustrated. The accounts include notes on their origin and uses written in a popular and interesting style. The black and white illustrations are an attractive feature.

635.65
†Fruwirth, C. 633.3
Landwirtschaftlich wichtige Hülsenfruchter. Erstes Heft. Erbsen, Ackerbohne, Lupinen, Wicken und Linse. (**Agriculturally important legumes. Part I. Peas, broad beans, lupins, vetches and lentils**). Paul Parey, Berlin 1936 : RM.2. Pp. 57. 9 illus. (Landw. Hefte 1936 : No. 29).

In the introduction to the third edition, revised by Dr H. Kreutz, is pointed out the importance to Germany to-day of increasing the production of leguminous plants, especially for forage; and a brief, general indication of their culture and uses is given.

There follows a description of the varieties of the five species mentioned with short directions for their cultivation.

Schulz, A. 678.1(91)
Der Plantagenkautschuk in Britisch-Malaya. (**Plantation rubber in British Malaya**).
Veröff. Inst. Meeresk. Univ. Berl. 1936 : Neue Folge No. 11 : Pp. 96.

This pamphlet is concerned with three main problems: (1) the factors which established the rubber industry in British Malaya in a leading position, (2) the effect of the rubber crisis in British Malaya and (3) the place of plantation rubber in the general economy of the country. The author traces the development of the industry in British Malaya including the loan of 1910 and the crisis of 1930–34. The question of labour is gone into in some detail and the position of the industry as a part of the economic system is analysed.

Cable, D. E. (Compiler) 678.1:016
1935 Annual bibliography of rubber literature (excluding patents).
Published by the Rubber Age, New York, 1936 : $1.00. Pp. 130.

In view of the ever-increasing uses to which rubber can be put and the fact that a considerable amount of literature appears in journals other than those devoted to rubber, this bibliography should be of assistance to all interested in the rubber industry. The abbreviations used for the titles of the journals are first given followed by the bibliography, conveniently classified, then an author and a subject index and in conclusion a guide to brand names, a list of classes of chemicals with their sources of supply and a list of chemical concerns with names and addresses.

NEW JOURNAL

Australian Forestry.

The Institute of Foresters of Australia has issued a journal, "Australian Forestry", which publishes original articles on subjects of interest to Australian foresters.

The journal is published half-yearly and the two numbers of Volume I set a high standard of achievement. A section of each number is devoted to reviews of forest literature. (Edited by J. O'Donnell, published in Perth, Western Australia. Price 7s. 6d. per number).

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